UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION IX
75 Hawthorne Street
San Francisco, CA 94105

February 17, 2009 VIA FEDERAL EXPRESS

Thomas C. Readal, President
Penreco, Inc.
8701 New Trails Drive, #175
The Woodlands, TX 77381

RE: Unilateral Administrative Order No. 2009-07: Cooper Drum Company Superfund Site

Dear Recipient of Unilateral Administrative Order No. 2009-07:

Enclosed please find the referenced Unilateral Administrative Order ("Order"). The Order requires the recipients ("Respondents") to conduct the cleanup of the Cooper Drum Company Superfund Site (the "Site") as set out in the attached Record of Decision and Statement of Work and to comply with all other provisions of the Order and the documents attached to and incorporated in the Order.

All Respondents were notified of their potential liability for cleanup of the Site by the Special Notice Letter dated May 23, 2008. The Special Notice Letter also required all Respondents to make a good-faith offer to perform the cleanup. EPA received offers on behalf of a number of Respondents, and conducted meetings to discuss those offers in August and September of 2008. Since the offers received by EPA, and discussed with Respondents, were partial offers, and were inadequate to conduct the entire cleanup of the Site, all offers were rejected as inadequate and the enclosed Order was prepared.

Please note that, as set out in paragraphs 94 and 95 of the Order, EPA will hold a conference on March 5, 2009, at 1:00 pm at the Embassy Suites Hotel, Presidential/Executive Meeting Room, 8425 Firestone Blvd., Downey, CA 90241. The purpose of the conference will be to discuss the Order and its implementation by the Respondents.

Please also note that, as set out in paragraph 96 of the Order, the effective date of the Order is March 19, 2009. Each Respondent is required, as set out in paragraph 26 of the Order, to submit the Notice of Intent to Comply with the Order by April 2, 2009, fourteen (14) days after the effective date.

If you have technical questions about the enclosed Order, please contact Eric Yunker of EPA's Superfund program at 415-972-3159. If you have legal questions about the Order, please contact Jim Collins of EPA's Office of Regional Counsel at 415-972-3894.

Sincerely,

Kathleen Salyer

Kathleen Salyer
Assistant Director, Superfund Division
California Site Cleanup Branch

Enclosures:

1. Unilateral Administrative Order 2009-07
2. Attachment 1 – Site Map
3. Attachment 2 – List of Respondents
4. Attachment 3 – Record of Decision
5. Attachment 4 – Remedial Design Reports, OU1 Groundwater and OU2 Soil
6. Attachment 5 – Statement of Work

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
Region 9

In The Matter Of:	)
	)
COOPER DRUM COMPANY SUPERFUND SITE	)
	)
A. G. Layne, Inc.	)
Ashland, Inc.	)
Atlantic Richfield Company	)
Baker Petrolite Corporation	)
Cargill, Inc.	)
Castrol Industrial North America, Inc.	)
Chemcentral Corporation	)
Chemtura Corporation	)
Chevron Corporation	)
Cooper Living Trust	)
Cooper Properties, LP	)
Coral Chemical Company	)
CRC Industries, Inc.	)
D.A. Stuart Company	)
Dunn Edwards Corporation	)
Engineered Polymer Solutions, Inc.	)
Exxon Mobil Oil Corporation	)
Gallade Chemical, Inc.	)
G.E. Betz, Inc.	)
Hasco Oil Company	)
Houghton International, Inc.	)
J.H. Mitchell & Sons, Distributors, Inc.	)
Lockheed-Martin Corporation	)
Lonza, Inc.	)
Lubricating Specialties Company	)
Mathisen Oil Company, Inc.	)
Pennzoil-Quaker State Company	)
Penreco, Inc.	)
Petrolock, Inc.	)
Powerine Oil Company	)
Quaker Chemical Corporation	)

Rathon Corporation Shell Chemical Company Shell Oil Company SOCO West, Inc. Southern California Edison Southern Counties Oil Company, LLP Stuart's Petroleum Corporation Texaco Refining & Marketing, Inc. Union Oil Company of California Univar USA, Inc. Viacom, Inc. Waste Management, Inc. Respondents.	)	
	)	U.S. EPA Docket No. 2009-07
Proceeding Under Section 106(a) of the Comprehensive Environmental Response, Compensation, and Liability Act of 1980, as amended, 42 U.S.C. § 9606(a), and under Section 7003 of the Solid Waste Disposal Act, as amended, 42 U.S.C. § 6973	)	

ADMINISTRATIVE ORDER
FOR REMEDIAL ACTION

TABLE OF CONTENTS

ATTACHMENTS

I. INTRODUCTION AND JURISDICTION

1. This Order directs Respondents to implement the remedial design for the remedy described in the Record of Decision for the Cooper Drum Company Superfund Site (the "Site") dated September 27 , 2002, by performing the remedial action. The remedial design for the remedy at the Site was certified as completed on September 21, 2007. This Order is issued to Respondents by the United States Environmental Protection Agency ("EPA") under the authority vested in the President of the United States by Section 106(a) of the Comprehensive Environmental Response, Compensation, and Liability Act of 1980, as amended ("CERCLA"), 42 U.S.C. § 9606(a). This authority was delegated to the Administrator of EPA on January 23, 1987, by Executive Order 12580 (52 Fed. Reg. 2926, January 29, 1987), and was further delegated to EPA Regional Administrators on May 11, 1994, by EPA Delegation No. 14-14-B. This authority was further delegated through the Director of the Superfund Division, EPA Region 9, to Region 9 Superfund Branch Chiefs by an Order dated November 16, 2007. This Order is also issued under the authority vested in the Administrator of EPA by Section 7003 of the Solid Waste Disposal Act, commonly referred to as the Resource Conservation and Recovery Act of 1976 ("RCRA"), as amended, 42 U.S.C. § 6901 et seq., which authority has been duly delegated to the Regional Administrator of EPA, Region IX, and further delegated to the Director of the Superfund Division and Superfund Branch Chiefs.

II. FINDINGS OF FACT

2. The Site is an approximately 3.8 acre parcel of land located in a mixed commercial, industrial and residential area. A map showing the location of the Site is attached as Attachment 1. The Site has been used to recondition steel drums that previously held a variety of industrial chemicals. EPA completed its Remedial Investigation of the Site in May 2002. The investigation concluded that substantial portions of the soil and groundwater beneath the Site have been contaminated by volatile organic compounds ("VOCs"), mainly chlorinated solvents such as trichloroethene ("TCE"), tetrachloroethene ("PCE"), and isomers of dichloroethene ("DCE") and dichloroethane

("DCA"). Other contaminants of concern are 1,4 dioxane in groundwater and polyaromatic hydrocarbons ("PAHs"), polychlorinated biphenyls ("PCBs") and lead in the soil.

3. The Respondents to this Order are identified in the caption of this Order and on Attachment 2 to this Order.

4. Respondents Cooper Living Trust and Cooper Properties, L.P. are the present owners of the Site ("Owner Respondents").

5. All other Respondents ("Generator Respondents") had ongoing business relationships with the Cooper Drum Company, which owned and operated the Site from 1972 through May of 1992. The business of each Generator Respondent involved the use, storage, and/or processing of hazardous substances and/or solid wastes. Cooper Drum Company, as a drum reconditioning operation, picked up or accepted for processing used 55 gallon drums from each of the Generator Respondents. Drums received at the Site from each Generator Respondent contained residues of hazardous substances and/or solid wastes. During drum reconditioning, residues contained in the drums were routinely released into the environment. The Site is now contaminated with hazardous substances and solid wastes of the same kind as used, stored and/or processed by the Generator Respondents at their own facilities during the course of their business relationships with Cooper Drum Company.

6. The Respondents referred to in paragraphs 4 and 5 are referred to collectively throughout this Order as "Respondents."

7. From 1996 to 2001, EPA undertook a Remedial Investigation and Feasibility Study ("RI/FS") for the Site, pursuant to CERCLA and the National Contingency Plan, 40 C.F.R. Part 300. In a report dated May, 15, 2002, EPA presented the results of the Cooper Drum Company RI and FS.

8. In June 2001, pursuant to Section 105 of CERCLA, 42 U.S.C. § 9605, EPA placed the Cooper Drum Site on the National Priorities List, set forth at 40 C.F.R. Part 300, Appendix B (49 Fed. Reg. 40320).

9. Pursuant to Section 117 of CERCLA, 42 U.S.C. § 9617, EPA published notice of the completion of the RI/FS and the proposed plan for remedial action in June, 2002, and provided opportunity for public comment on the proposed remedial action.

10. The decision by EPA on the remedial action to be implemented at the Cooper Drum Site is embodied in a Record of Decision ("ROD"), executed September 27, 2002, on which the State has given its concurrence. The ROD is attached to this Order as Attachment 3 and is incorporated by reference. The ROD is supported by an administrative record that contains the documents and information upon which EPA based the selection of the response action.

11. The highest concentrations of contaminants of concern found in environmental Site media (soil vapor, soil, and groundwater) include: 1) Soil Vapor, with total VOC soil vapor concentrations up to 1,400,000 parts per billion by volume (ppbv) including cis-1,2-DCE up to 430,000 ppbv; 2) Soil, with PCB concentrations up to 5,500 parts per billion (ppb), PAHs, including benzo(a)pyrene up to 4,300 ppb, and lead up to 3,240 parts per million (ppm); and 3) Groundwater, with concentrations up to 490 ppb of TCE, 460 ppb of DCE, and 450 ppb of 1,4 dioxane.

Hazardous substances and solid wastes released at and from the Site have moved downward from the ground surface through the soil column and into underlying groundwater, resulting in both soil and groundwater contamination. Evidence of downward, chemical migration through the soil column and into the groundwater includes the relative distribution and concentrations of the soil vapor, soil, and groundwater samples collected from beneath and hydraulically downgradient from the Site, demonstrating the presence of PCE, TCE, and other Site-related chemicals used at the Generator Respondents' facilities and transported to the Site in the course of the Generator Respondents' business dealings with the Cooper Drum Company.

The resulting groundwater contamination has generally migrated from the Site in a southerly direction through the upper aquifer The groundwater in this upper aquifer is designated as a potential drinking water source in the Los Angeles Regional Water Quality Control Board's Water Quality Control Plan (Basin Plan). Several deeper groundwater aquifers contiguous to and beneath the Site are currently used for domestic purposes, including drinking water, and are presently endangered by Site contaminants migrating laterally and vertically from the shallow aquifer towards and into the deeper aquifers.

The Human Health Risk Assessment completed by EPA in 2002, described in detail in the ROD, evaluated potential exposure pathways and concluded that, without Site remediation, there would be an increased health risk to: on-site outdoor workers exposed to soil contaminants if surface soils are disturbed; on-site indoor workers exposed to vapor intrusion from contaminated Site soils; and on-site and off-site users of area groundwater for domestic purposes (e.g. washing, bathing, laundry, and drinking water) as a result of ingestion, dermal contact and inhalation of contaminated groundwater.

12. Response actions at the Site have included EPA's RI/FS activities (approximately 1996 through 2001); soil, soil gas, and groundwater investigations; and development of the Remedial Design ("RD")(2007).

13. The selected remedy for soils and groundwater, as embodied in the ROD, provides for addressing the contamination at the Site and removing the risks to human health and the environment as follows:

a) Extraction and treatment of VOC-contaminated soil vapor in the vadose zone by Dual Phase Extraction technology, to address the threat of exposure to on-site workers from these contaminants and to prevent contaminants from migrating into groundwater;

b) Installation and operation of an on-site source area groundwater treatment system to address contamination in the upper aquifer underlying the Site;

c) Installation and operation of a Downgradient Containment and Treatment System to address groundwater contamination which has migrated into portions of the upper aquifer contiguous to and downgradient from the Site, to alleviate the threat that contamination will migrate further laterally and vertically to the deep aquifer; and

d) Excavation and off-site disposal of soils contaminated with non-VOCs, to address the threat of exposure to on-site workers from these contaminants during soil disturbing activities. Institutional controls will be enacted should any of this waste be left in place.

III. CONCLUSIONS OF LAW AND DETERMINATIONS

14. The Site is a "facility" as defined in Section 101(9) of CERCLA, 42 U.S.C. § 9601(9).

15. The substances listed in paragraphs 2 and 11 of this Order are found at the Site and are "hazardous substances" as defined in Section 101(14) of CERCLA, 42 U.S.C. § 9601(14), and/or are "solid wastes" as defined in Section 1004(27) of RCRA, 42 U.S.C. § 6903(27).

16. The hazardous substances and solid wastes listed in paragraphs 2 and 11 of this Order have been disposed of at the Site and there has been a release or threatened release of these substances from the Site into the soil and groundwater.

17. Owner Respondents and Generator Respondents are "persons" as defined in Section 101(21) of CERCLA, 42 U.S.C. § 9601(21) and as defined in Section 1004(15) of RCRA, 42 U.S.C. § 6903(15).

18. The Owner Respondents are liable parties as defined in Section 107(a)(1) of CERCLA, 42 U.S.C. § 9607(a)(1), and are subject to this Order under Section 106(a) of CERCLA, 42 U.S.C. § 9606(a) because they are the present owners of the Site. The Generator Respondents are liable parties as defined in section 107(a)(3) of CERCLA, 42 U.S.C. Section 9607(a)(3), and are subject to this Order under section 106(a) of CERCLA, 42 U.S.C. Section 9606(a) because they are persons who by contract, agreement, or otherwise arranged for disposal or arranged with a transporter for transport for disposal of hazardous substances owned or possessed by them at the Site. Respondents are liable under Section 7003 of RCRA, 42 U.S.C. § 6973, because they contributed to the handling, storage, treatment, transportation or disposal of solid wastes at the Site.

19. There have been releases of hazardous substances at or from the Site as defined in Section 101(22) of CERCLA, 42 U.S.C. § 9601(22), including but not limited to the past disposal of hazardous substances at the Site and the migration of hazardous substances from the Site.

20. The potential for future migration of hazardous substances from the Site poses a "threat of a release" as defined in Section 101(22) of CERCLA, 42 U.S.C. § 9601(22).

21. The release or threat of release of one or more hazardous substances from a facility may present an imminent and substantial endangerment to the public health or welfare or the environment under Section 106(a) of CERCLA, 42 U.S.C. § 9606(a). The substances listed in Paragraphs 2 and 11 of this Order are solid wastes that may present an imminent and substantial endangerment to health or the environment under Section 7003 of RCRA, 42 U.S.C. § 6973.

22. The contamination and endangerment at this Site constitute an indivisible injury. The actions required by this Order are necessary to protect the public health, welfare, and the environment. Respondents are jointly and severally responsible for all of the contamination at the Site.

IV. NOTICE TO THE STATE

23. On January 23, 2009, prior to issuing this Order, EPA notified the State of California Department of Toxic Substances Control that EPA would be issuing this Order.

V. ORDER

24. Based on the foregoing, Respondents are hereby ordered, jointly and severally, to comply with the following provisions, including but not limited to all attachments to this Order, all documents incorporated by reference into this Order, and all schedules and deadlines in this Order, attached to this Order, or incorporated by reference into this Order:

VI. DEFINITIONS

25. Unless otherwise expressly provided herein, terms used in this Order which are defined in CERCLA and RCRA or in regulations promulgated under CERCLA and RCRA shall have the meaning assigned to them in the statute or its implementing regulations. Whenever terms listed

below are used in this Order or in the documents attached to this Order or incorporated by reference into this Order, the following definitions shall apply:

A. "CERCLA" shall mean the Comprehensive Environmental Response, Compensation, and Liability Act of 1980, as amended. 42 U.S.C. sections 9601 et. seq.

B. "Day" shall mean a calendar day unless expressly stated to be a working day. "Working day" shall mean a day other than a Saturday, Sunday, or Federal holiday. In computing any period of time under this Order, where the last day would fall on a Saturday, Sunday, or Federal holiday, the period shall run until the end of the next working day.

C. "DTSC"shall mean the California Department of Toxic Substances Control and any successor departments or agencies of DTSC.

D. "EPA" shall mean the United States Environmental Protection Agency.

E. "National Contingency Plan" or "NCP" shall mean the National Contingency Plan promulgated pursuant to Section 105 of CERCLA, 42 U.S.C. § 9605, codified at 40 C.F.R. Part 300, including any amendments thereto.

F. "Operable Unit" or "OU" shall refer to one of two environmental media as follows:

1) The groundwater Operable Unit (OU1) means the groundwater aquifers, underlying the Site and hydraulically downgradient where the contaminated plume has migrated, which are contaminated with hazardous substances and solid wastes.

2) The soil Operable Unit (OU2) means the portions of the soils underlying the Site which are contaminated with hazardous substances and solid wastes.

G. "Operation and Maintenance" or "O&M" shall mean all activities required under the Operation and Maintenance Manuals developed by Respondents pursuant to this Order and Section III of the SOW, and approved by EPA.

H. "Paragraph" shall mean a portion of this Order identified by an arabic numeral.

I. "Performance Standards" shall mean those cleanup standards, standards of control, and other substantive requirements, criteria or limitations, identified in the SOW and the ROD, that the Remedial Action and Work required by this Order must attain and maintain.

J. "RCRA" shall mean the Solid Waste Disposal Act, as amended, 42 U.S.C. §§ 6901 et seq. (also known as the Resource Conservation and Recovery Act).

K. "Record of Decision" or "ROD" shall mean the EPA Record of Decision relating to the Site, signed on September 27, 2002, by John Kemmerer, the Chief of the Superfund Site Cleanup Branch, EPA Region 9, and all attachments thereto.

L. "Remedial Action" or "RA" shall mean those activities, except for Operation and Maintenance, to be undertaken by Respondents to implement the final plans and specifications submitted by Respondents pursuant to the Remedial Action (RA) Work Plan(s) approved by EPA, including any additional activities required under Sections X, XI, XII, XIII, and XIV of this Order.

M. "Remedial Action Work Plan(s)" shall mean the work plan(s) setting forth the work to be performed by Respondents under this Order, as more fully described in Section IX of this Order and in the SOW.

N. "Remedial Design" or "RD" shall mean those activities undertaken by EPA and completed on September 21, 2007 to develop the design, plans and specifications for the Remedial Action.

O. "Remedial Design Reports" (RD Reports) shall mean the reports containing the Remedial Designs for soils and groundwater at the Site attached as Attachment 4 to this Order.

P. "Section" shall mean a portion of this Order identified by a roman numeral which includes one or more paragraphs.

Q. "Site", also referred to as "Cooper Drum" or "the Cooper Drum Superfund Site", shall mean the areal extent of all contamination at and from the area depicted in the map at Attachment 1, which includes the former drum reconditioning facility at 9316 Atlantic Avenue, City of South Gate, Los Angeles, California. The Site is composed of two Operable Units: OU1 (groundwater) and OU2 (soil).

R. "Statement of Work" or "SOW" shall mean the statement of work for implementation of the Remedial Action, and Operation and Maintenance at the Site, set forth in Attachment 5 to this Order. The Statement of Work is incorporated into this Order and is an enforceable part of this Order.

S. "State" shall mean the State of California Department of Toxic Substances Control.

T. "United States" shall mean the United States of America.

U. "Work" shall mean all activities Respondents are required to perform under this Order, including but not limited to Remedial Action, Operation and Maintenance, and any activities required to be undertaken pursuant to Sections VII through XXIV, and XXVII of this Order.

VII. NOTICE OF INTENT TO COMPLY

26. Respondents shall provide, not later than fourteen (14) days after the effective date of this Order, written notice to EPA's Remedial Project Manager ("RPM") stating whether they will comply with the terms of this Order. If Respondents do not unequivocally commit to perform the Work as provided by this Order, they shall be deemed to have violated this Order and to have failed or refused to comply with this Order. Respondents' written notice shall describe, using facts that exist on or prior to the effective date of this Order, any "sufficient cause" defenses

asserted by Respondents under Sections 106(b) and 107(c)(3) of CERCLA, 42 U.S.C. §§ 9606(b) and 9607(c)(3). The absence of a response by EPA to the notice required by this paragraph shall not be deemed to be acceptance of Respondents' assertions.

VIII. PARTIES BOUND

27. This Order shall apply to and be binding upon each Respondent identified in the caption and Attachment 2 of this Order, its directors, officers, employees, agents, successors, and assigns. Respondents are jointly and severally responsible for carrying out all activities required by this Order. Each Respondent shall communicate and cooperate with the other Respondents. No change in the ownership, corporate status, or other control of any Respondent shall alter any of the Respondents' responsibilities under this Order.

28. Respondents shall provide a copy of this Order to any prospective owners or successors before a controlling interest in any Respondent's assets, property rights, or stock are transferred to the prospective owner or successor. Respondents shall provide a copy of this Order to each contractor, sub-contractor, laboratory, or consultant retained to perform any Work under this Order within fourteen (14) days after the effective date of this Order or on the date such services are retained, whichever date occurs later. Respondents shall also provide a copy of this Order to each person representing Respondents with respect to the Site or the Work and shall condition all contracts and subcontracts entered into hereunder upon performance of the Work in conformity with the terms of this Order. With regard to the activities undertaken pursuant to this Order, each contractor and subcontractor shall be deemed to be related by contract to the Respondents within the meaning of Section 107(b)(3) of CERCLA, 42 U.S.C. § 9607(b)(3). Notwithstanding the

terms of any contract, Respondents are responsible for compliance with this Order and for ensuring that their contractors, subcontractors and agents comply with this Order, and perform any Work in accordance with this Order.

IX. WORK TO BE PERFORMED

29. Respondents shall cooperate with EPA in providing information to the public regarding the Work to be performed. As requested by EPA, Respondents shall participate in the preparation of such information for distribution to the public and in public meetings, which may be held or sponsored by EPA to explain activities at or relating to the Site. Respondents shall implement the Remedial Action in accordance with the ROD and the SOW.

30. All aspects of the Work to be performed by Respondents pursuant to this Order shall be under the direction and supervision of a qualified project manager, the selection of whom shall be subject to approval by EPA. Within forty-five (45) days after the effective date of this Order, Respondents shall notify EPA in writing of the name and qualifications of the project manager, including primary support and staff, proposed to be used in carrying out Work under this Order. With respect to any proposed project manager, Respondents shall demonstrate that the proposed project manager has a quality system that complies with ANSI/ASQC E4-1994, "Specifications and Guidelines for Quality Systems for Environmental Data Collection and Environmental Technology Programs," (American National Standard, January 5, 1995), by submitting a copy of the proposed project manager's Quality Management Plan (QMP). The QMP should be prepared in accordance with the specifications set forth in "EPA Requirements for Quality Management

Plans (QA/R2)" (EPA/240/B-01/002, March 2001) or equivalent documentation as determined by EPA. If at any time Respondents propose to use a different project manager, Respondents shall notify EPA and shall obtain approval from EPA before the new project manager performs any work under this Order.

31. EPA will review the Respondents' project manager selection. If EPA disapproves of the selection of the project manager, Respondents shall submit to EPA, within 30 days after receipt of EPA's disapproval of the project manager previously selected, a list of project managers, including primary support and staff, that would be acceptable to Respondents. EPA will thereafter provide written notice to Respondents of the names of the project managers that are acceptable to EPA. Respondents may then select any approved project manager from that list and shall notify EPA of the name of the project manager selected within twenty one (21) days of EPA's designation of approved project managers.

32. RA Work Plans. The RA will be conducted in three phases as described in Section IV-B of the SOW. Phase 1 will require preparing two separate work plans for remediation of VOCs in the soil and groundwater source area. Phases 2 and 3 will require preparing a single work plan for each phase. The Respondents shall submit a total of four RA Work Plans as follows:

a) Two Phase 1 RA Work Plans, which shall include details for (1) the OU2 Dual Phase Extraction (DPE) System (DPE Work Plan), and (2) the OU1 Groundwater Source Area System (GSA Work Plan);

b) The Phase 2 RA Work Plan, which shall include details for the OU1 Downgradient Containment and Treatment System (DCT Work Plan); and

c) The Phase 3 RA Work Plan, which shall include details for the OU2 Soil Excavation and Disposal and Institutional Controls (Soil E/IC Work Plan).

The RA Work Plans must be reviewed and approved by EPA.

33. Schedule for Submission of RA Work Plans.

a) Within one hundred-twenty (120) days after the effective date of this Order, Respondents shall submit the Phase 1RA Work Plans (the OU2 Dual Phase Extraction (DPE) Work Plan and the OU1 Groundwater Source Area (GSA) Work Plan), as set out in Section IV(B) of the SOW, to EPA for its review and approval.

b) Within 60 days after approval of the Phase 1 Work Plans for the OU2 DPE and the OU1 GSA systems, Respondents shall submit the Phase 2 RA Work Plan (the OU1 Downgradient Containment and Treatment (DCT) Work Plan) to EPA for its review and approval.

c) Within 60 days of the Interim Remedial Action Report for the OU2 DPE, the Respondents shall submit the Phase 3 RA Work Plan (the OU2 Soil Excavation and Disposal and Institutional Controls (Soil E/IC) Work Plan) to EPA for its review and approval.

34. Work Plan Requirements.

a) Each RA Work Plan shall include a description of the work to be implemented by Respondents and shall be developed in accordance with the ROD, and the SOW, and shall be consistent with the Final Design as approved by EPA.

b) Each RA Work Plan shall contain step-by-step plans for completing the Remedial Action and for attaining and maintaining all requirements, including Performance Standards (including ARARs), identified in the SOW.

c) Each RA Work Plan shall describe in detail the tasks and deliverables Respondents will complete during the remedial action phases, and a schedule for completing construction activities and all other tasks and deliverables pursuant to the schedule of deliverables described in the SOW.

1) The major tasks and deliverables described in the DPE Work Plan for OU2 shall include, but not be limited to, the details for the installation and operation of the DPE system for treatment of the VOCs in soil, and preparation of the Soil Monitoring Plan and Sampling and Analysis Plan ("SAP") as set out in the RD Reports and the SOW.

2) The major tasks and deliverables described in the GSA Work Plan for OU1 shall include, but not be limited to, the details for the installation and operation of the source area treatment system and preparation of the Groundwater Monitoring Plan and the SAP as set out in the RD Reports and the SOW.

3) The major tasks and deliverables described in the DCT Work Plan for OU1 shall include, but not be limited to, details for the installation and operation of the downgradient contaminant and treatment system and preparation of the Groundwater Monitoring Plan and the SAP as set out in the RD Reports and the SOW.

4) The major tasks and deliverables described in the Soil E/IC Work Plan shall include, but not be limited to, details for excavation and disposal of non-VOCs in soil and implementation of institutional controls for soil contaminants that may be left in place.

d) Each RA Work Plan shall provide for identification and satisfactory compliance with applicable permitting requirements, sampling and analysis plans, Construction Quality Assurance Plans, Operation and Maintenance Manuals and Compliance Monitoring Plans.

e) Each RA Work Plan shall also include a description of the responsibilities and qualifications of key personnel expected to direct or play a significant role in the RA and/or O&M, shall identify initiation and completion dates for each design or construction activity, inspection and deliverable required by the SOW schedule (Section V), shall briefly describe the planned contracting strategy, shall describe the roles and responsibilities of third parties necessary for construction and O&M of the RA, shall describe additional data collection efforts, if any, required for supplementation of the RD, shall describe plans for acquiring property, leases, easements or other access necessary for implementation of the RA and shall contain all other plans and descriptions set out in Section IV(B) of the SOW.

f) Each RA Work Plan shall provide for implementing the attached SOW, and shall comport with EPA's "Superfund Remedial Design/Remedial Action Handbook," U.S. EPA, Office of Emergency and Remedial Response, June 15, 1995, EPA 540/R-95/059. Upon approval by EPA, the RA Work Plans and future revisions or addenda to the RA Work Plans are incorporated into this Order as requirements of this Order and shall be enforceable parts of this Order.

35. Upon approval of each RA Work Plan by EPA, Respondents shall implement the RA Work Plans according to the schedules in that approved RA Work Plan. Any violation of an RA Work Plan shall be a violation of this Order.

36. Within sixty (60) days after EPA approval of each of the Phase 1 and Phase 2 RA Work Plans, Respondents shall submit Groundwater and Soil Vapor Monitoring Plans as set out in Sections IV(J) and IV(K) of the SOW.

37. Respondents shall submit Construction Bid Packages for each RA thirty (30) days after EPA approval of each RA Work Plan.

38. Within sixty (60) days after issuance of each Construction Bid Package, Respondent shall perform the Selection of the Construction Contractor and shall notify EPA within five (5) days thereafter of the Construction Contractor selected.

39. Within fourteen (14) days after selection of each Construction Contractor, Respondents shall convene a Pre-Construction Meeting with EPA. Thirty (30) days after the Pre-Construction Meeting, Respondents shall initiate construction for each of the approved Work Plan remedies.

40. Fourteen (14) days after Respondents determine that all aspects of the plans and specifications for each of the RAs have been implemented and are operating as designed, Respondents shall conduct the Pre-Final Construction Inspection for each RA. Twenty-one (21) days after the Pre-Final Construction Inspection, Respondents shall submit the Pre-Final Construction Inspection Report. Respondents shall conduct a Final Construction Inspection within twenty-one (21) days after submission of the Pre-Final Construction Report. Within twenty-one (21) days of such Final Construction Inspection, Respondents shall submit a Final Construction Inspection Report for each RA.

41. Within sixty (60) days after each Final Construction Inspection Report is submitted, Respondents shall submit a draft of the Remedial Action Construction Completion Report for each of the four RA Work Plans.

42. Within ninety (90) days after construction is initiated, Respondents shall submit the draft O & M Manual for each RA Work Plan pursuant to Section IV(I) of the SOW, except for Phase 3 Soil E/IC.

43. Within two hundred - seventy (270) days after EPA approval of each Remedial Action Construction Completion Report, or fourteen (14) days after Respondents determine that performance criteria for each RA, as set out in Section III of the SOW, are being met, whichever is earlier, Respondents shall submit a draft of the Interim Remedial Action Report for each RA. If needed, the Revised Interim Remedial Action Report shall be submitted within twenty eight (28) days after receipt of EPA comments.

44. Respondents shall submit with any plan requiring field activities (1) a Site Management Plan (conforming to Section IV(N)(1) of the SOW), (2) a Sampling and Analysis Plan (conforming to Section IV(N)(2) of the SOW, (3) a Site Health and Safety Plan (conforming to Section IV(N)(3) of the SOW, and (4) a Construction Quality Assurance Plan (conforming to Section IV(N)(4) of the SOW.

45. Forty-five days (45) after Respondents conclude that all Work, including all O&M activities, has been performed for each RA, and cleanup goals attained, Respondents shall conduct the Pre-

Certification Inspection for Completion of the Work for each RA. Thirty days after the Pre-Certification Inspection, Respondents shall submit the Certification that all Work has been completed. A Final Remedial Action Report shall be submitted within ninety (90) days after completion of the pre-certification inspection for each RA. If needed, the Revised Final Remedial Action Report shall be submitted within twenty-eight (28) days after receipt of EPA comments.

46. The Work performed by Respondents pursuant to this Order shall, at a minimum, achieve the Performance Standards specified in Section III of the SOW. Notwithstanding any action by EPA, Respondents remain fully responsible for achievement of the Performance Standards in the ROD and the SOW. Nothing in this Order, or in the ROD or SOW, or in EPA's approval of the RA Work Plans, or EPA's approval of any other submission, shall be deemed to constitute a warranty or representation of any kind by EPA that full performance of the Remedial Actions will achieve the Performance Standards set forth in Section III of the SOW. Respondents' compliance with such approved documents does not foreclose EPA from seeking additional work to achieve the applicable performance standards.

47. Respondents shall, prior to any off-site shipment of hazardous substances from the Site to an out-of-state waste management facility, provide written notification to the appropriate state environmental official in the receiving state and to EPA's Remedial Project Manager ("RPM") of such shipment of hazardous substances. However, the notification of shipments shall not apply to any shipments when the total volume of all shipments from the Site to such state will not exceed ten (10) cubic yards.

a) The notification shall be in writing, and shall include the following information, where available: (1) the name and location of the facility to which the hazardous substances are to be shipped; (2) the type and quantity of the hazardous substances to be shipped; (3) the expected schedule for the shipment of the hazardous substances; and (4) the method of transportation. Respondents shall notify the receiving state of major changes in the shipment plan, such as a decision to ship the hazardous substances to another facility within the same state, or to a facility in another state.

b) The identity of the receiving facility and State will be determined by Respondents following the award of the contract for Remedial Action construction. Respondents shall provide all relevant information, including information under the categories noted in paragraph 48(1), above, on the shipments as soon as practicable after the award of the contract and before the hazardous substances are actually shipped.

X. FAILURE TO ATTAIN PERFORMANCE STANDARDS

48. In the event that EPA determines that additional response activities are necessary to meet applicable Performance Standards, EPA may notify Respondents that additional response actions are necessary.

49. Unless otherwise stated by EPA, within thirty (30) days of receipt of notice from EPA that additional response activities are necessary to meet any applicable Performance Standards, Respondents shall submit for approval by EPA a work plan for the additional response activities. The work plan shall conform to the applicable requirements of Sections IX, XVI, and XVII of

this Order. Upon EPA's approval of the work plan pursuant to Section XIV, Respondents shall implement the work plan for additional response activities in accordance with the provisions and schedule contained therein.

XI. EPA PERIODIC REVIEW

50. Under Section 121(c) of CERCLA, 42 U.S.C. § 9621(c), and any applicable regulations, EPA may conduct a review at the Site to assure that the Work performed pursuant to this Order adequately protects human health and the environment. Until such time as EPA certifies completion of the Work, Respondents shall conduct the requisite studies, investigations, or other response actions as determined necessary by EPA in order to permit EPA to conduct the review under Section 121(c) of CERCLA. As a result of any review performed under this paragraph, Respondents may be required to perform additional Work or to modify Work previously performed.

XII. ADDITIONAL RESPONSE ACTIONS

51. EPA may determine that in addition to the Work identified in this Order and attachments to this Order, additional response activities may be necessary to protect human health and the environment. If EPA determines that additional response activities are necessary, EPA may require Respondents to submit a work plan for additional response activities. EPA may also require Respondents to modify any plan, design, or other deliverable required by this Order, including any approved modifications.

52. Not later than thirty (30) days after receiving EPA's notice that additional response activities are required pursuant to this Section, Respondents shall submit a work plan for the response activities to EPA for review and approval. Upon approval by EPA, the work plan is incorporated into this Order as a requirement of this Order and shall be an enforceable part of this Order. Upon approval of the work plan by EPA, Respondents shall implement the work plan according to the standards, specifications, and schedule in the approved work plan. Respondents shall notify EPA of their intent to perform such additional response activities within seven (7) days after receipt of EPA's request for additional response activities.

XIII. ENDANGERMENT AND EMERGENCY RESPONSE

53. In the event of any action or occurrence during the performance of the Work which causes or threatens to cause a release of a hazardous substance or which may present an immediate threat to public health or welfare or the environment, Respondents shall immediately take all appropriate action to prevent, abate, or minimize the threat, and shall immediately notify EPA's RPM or, if the RPM is unavailable, EPA's Alternate Project Manager. If neither of these persons is available, Respondents shall notify the EPA Emergency Response Section, Region 9, at (800)-300-2193. Respondents shall take such action in consultation with EPA's RPM and in accordance with all applicable provisions of this Order, including but not limited to the Health and Safety Plan. In the event that Respondents fail to take appropriate response action as required by this Section, and EPA takes that action instead, Respondents shall reimburse EPA for all costs of the response action not inconsistent with the NCP. Respondents shall pay the response costs in the manner described in Section XXIV of this Order, within thirty (30) days of

Respondents' receipt of demand for payment and a reconciled EPA financial cost summary of the costs incurred.

54. Nothing in the preceding paragraph shall be deemed to limit any authority of the United States to take, direct, or order all appropriate action to protect human health and the environment or to prevent, abate, or minimize an actual or threatened release of hazardous substances on, at, or from the Site.

XIV. EPA REVIEW OF SUBMISSIONS

55. All deliverables shall be submitted to EPA, and DTSC concurrently. EPA will, to the extent feasible, incorporate DTSC's comments, if any, into EPA's comments on the deliverable. After review of any deliverable, plan, report or other item which is required to be submitted for review and approval pursuant to this Order, EPA may: (a) approve the submission; (b) approve the submission with modifications; (c) disapprove the submission and direct Respondents to re-submit the document after incorporating EPA's comments; or (d) disapprove the submission and assume responsibility for performing all or any part of the response action. As used in this Order, the terms "approval by EPA," "EPA approval," or a similar term means the action described in items (a) or (b) of this paragraph.

56. In the event of approval or approval with modifications by EPA, Respondents shall proceed to take any action required by the plan, report, or other item, as approved or modified by EPA.

57. Upon receipt of a notice of disapproval or a request for a modification pursuant to paragraphs 55(b) or 55(c), Respondents shall, within the time specified in the attached SOW or such longer time as specified by EPA in its notice of disapproval or request for modification, correct the deficiencies and resubmit the plan, report, or other item for approval. Notwithstanding the notice of disapproval, or approval with modifications, Respondents shall proceed, at the direction of EPA, to take any action required by any non-deficient portion of the submission.

58. If any submission is disapproved by EPA pursuant to paragraph 55(d), Respondents shall be deemed to be in violation of this Order.

XV. PROGRESS REPORTS

59. In addition to the other deliverables set forth in this Order, Respondents shall provide monthly progress reports to EPA and to the State with respect to actions and activities undertaken pursuant to this Order and weekly construction activity progress reports during construction. The monthly progress reports shall commence sixty (60) days after the effective date of this Order. Respondents' obligation to submit progress reports continues until EPA gives Respondents written notice that the Work has been completed. At a minimum the monthly progress reports shall: (1) describe the actions which have been taken to comply with this Order during the prior month; (2) summarize test, sampling, or operating data generated or obtained by Respondents; (3) provide any preliminary calculations and supporting data used to evaluate performance; (4) describe all work planned for the next two months with schedules relating such work to the overall project schedule for RD/RA completion; and (5) describe all problems encountered

(including the nature of and duration of any noncompliance) and any anticipated problems, any actual or anticipated delays, and solutions developed and implemented to address any actual or anticipated problems or delays. Weekly construction activity reports shall commence when construction is initiated. At a minimum the weekly reports shall: (1) summarize field logs and daily reports of construction work performed each week; (2) provide the results of any inspections or monitoring conducted during construction work; and (3) describe work activities planned for the following week and any significant issues that may affect meeting the construction schedule.

XVI. QUALITY ASSURANCE, SAMPLING AND DATA ANALYSIS

60. Respondent shall use the quality assurance, quality control, and chain of custody procedures described in the "EPA Requirements for Quality Assurance Project Plans (QA/R-5),(EPA/240/B-01/003, March 2001) and "Guidance for Quality Assurance Project Plans (QA/G-5)" (EPA/240/R-02/009, December 2002), and any amendments to these documents, while conducting all sample collection and analysis activities required herein by any plan. To provide quality assurance and maintain quality control, Respondents shall:

a) use only laboratories which have a documented quality system that complies with ANSI/ASQC E4-1994, "Specifications and Guidelines for Quality Systems for Environmental Data Collection and Environmental Technology Programs," (American National Standard, January 5, 1995) and "EPA Requirements for Quality Management Plans (QA/R2)" (EPA/240/B-01/002, March 2001) or equivalent documentation as determined by EPA. EPA may consider laboratories accredited under the National Environmental Laboratory Accreditation Program (NELAP) to meet the quality system requirements;

b)ensure that the laboratory used by the Respondents for analyses performs according to a method or methods deemed satisfactory to EPA, submits all protocols to be used for analyses to EPA at least 14 days before beginning analysis, and maintains protocols according to the record preservation requirements included in Section XXI;

c)ensure that EPA personnel and EPA's authorized representatives are allowed access to the laboratory and personnel utilized by the Respondents for analyses.

61. Respondents shall notify EPA not less than fourteen (14) days in advance of any sample collection activity. At the request of EPA, Respondents shall allow split or duplicate samples to be taken by EPA or its authorized representatives, of any samples collected by Respondents with regard to the Site or pursuant to the implementation of this Order. In addition, EPA shall have the right to take any additional samples that EPA deems necessary.

XVII. COMPLIANCE WITH APPLICABLE LAWS

62. All activities by Respondents pursuant to this Order shall be performed in accordance with the requirements of all Federal and state laws and regulations. EPA has determined that the activities contemplated by this Order are consistent with the National Contingency Plan (NCP).

63. Except as provided in Section 121(e) of CERCLA and the NCP, no permit shall be required for any portion of the Work conducted entirely on-site. Where any portion of the Work requires a

Federal, state or local permit or approval, Respondents shall submit timely applications and take all other actions necessary to obtain and to comply with all such permits or approvals. For any treated water which will be put into a public water supply, all legal requirements for drinking water in existence at the time that the water is served will have to be met because EPA considers serving of the water to the public (at the tap) to be off-site.

64.This Order is not, and shall not be construed to be, a permit issued pursuant to any Federal or state statute or regulation.

65. All materials removed from the Site Area shall be disposed of or treated at a facility approved by EPA's RPM and in accordance with Section 121(d)(3) of CERCLA, 42 U.S.C. § 9621(d)(3); with the U.S. EPA Off-Site Rule, 40 C.F.R § 300.440; and with all other applicable Federal, state, and local requirements.

XVIII. EPA REMEDIAL PROJECT MANAGER

66. All communications, whether written or oral, from Respondents to EPA shall be directed to EPA's Remedial Project Manager ("RPM"). Respondents shall submit to EPA three copies of all documents, including plans, reports, and other correspondence, which are developed pursuant to this Order, and shall send these documents by overnight mail or by certified mail, return receipt requested. Respondents shall also submit one copy of each deliverable to the project manager for DTSC and any other State agencies specified by the EPA RPM.

EPA's Remedial Project Manager is:

Eric Yunker
U.S. Environmental Protection Agency
75 Hawthorne Street (SFD-7-3)
San Francisco, CA 94105
(415) 972-3159 [YUNKER.ERIC@EPA.GOV]

EPA's Alternate Remedial Project Manager is:

Richard Hiett, Chief
California Site Cleanup Section 3
U.S. Environmental Protection Agency
75 Hawthorne Street (SFD-7-3)
San Francisco, CA 94105
(415) 972-3170 [HIETT.RICHARD@EPA.GOV]

DTSC's Project Manager is:

Lori Parnass
California Department of Toxic Substances Control
9211 Oakdale Avenue
Chatsworth, CA 91311
(818) 717-6546 [LParnass@dtsc.ca.gov]

One or more copies of each deliverable shall also be sent to EPA contractors, as specified by the EPA RPM.

67. EPA has the unreviewable right to change its RPM. If EPA changes its RPM, EPA will inform Respondents in writing of the name, address, and telephone number of the new RPM.

68. EPA's RPM and Alternate RPM shall have the authority lawfully vested in a Remedial Project Manager (RPM) and On-Scene Coordinator (OSC) by the NCP. EPA's RPM and

Alternate RPM shall have authority, consistent with the NCP, to halt any work required by this Order, and to take any necessary response action.

69. Within twenty-eight (28) days after the effective date of this Order, Respondents shall designate a Project Coordinator and shall submit the name, address, and telephone number of the Project Coordinator to EPA for review and approval. Respondents' Project Coordinator shall be responsible for Respondents' implementation of this Order. If Respondents wish to change the Project Coordinator, Respondents shall provide written notice to EPA, five (5) days prior to changing the Project Coordinator, of the name and qualifications of the new Project Coordinator. Respondents' selection of a Project Coordinator shall be subject to EPA approval.

XIX. ACCESS TO SITE NOT OWNED BY RESPONDENTS

70. To the extent that access to any portion of the Site area, or any other property, is owned or controlled by persons other than Respondents and is necessary in order to perform the Work required by this Order, Respondents will obtain, or use their best efforts to obtain, site access agreements from the present owner prior to initiating construction activities. Such agreements shall provide access for EPA, its contractors and oversight officials, the state and its contractors, and Respondents or Respondents' authorized representatives and contractors, and such agreements shall specify that Respondents are not EPA's representatives with respect to liability associated with activities at the property. Respondents shall save and hold harmless the United States and its officials, agents, employees, contractors, subcontractors, or representatives for or from any and all claims or causes of action or other costs incurred by the United States including

but not limited to attorneys fees and other expenses of litigation and settlement arising from or on account of acts or omissions of Respondents, their officers, directors, employees, agents, contractors, subcontractors, and any persons acting on their behalf or under their control, in carrying out activities pursuant to this Order, including any claims arising from any designation of Respondents as EPA's authorized representatives under Section 104(e) of CERCLA. Copies of such agreements shall be provided to EPA prior to Respondents' initiation of field activities. Respondents' best efforts shall include the payment of reasonable sums of money in consideration of access. If access agreements are not obtained within the time referenced above, Respondents shall immediately notify EPA of their failure to obtain access. Subject to the United States' unreviewable discretion, EPA may use its legal authorities to obtain access for the Respondents, may perform those response actions with EPA contractors at the property in question, or may terminate the Order if Respondents cannot obtain access agreements. If EPA performs those tasks or activities with contractors and does not terminate the Order, Respondents shall perform all other activities not requiring access to that property, and shall reimburse EPA, pursuant to Section XXIV of this Order, for all costs incurred in performing such activities. Respondents shall integrate the results of any such tasks undertaken by EPA into its reports and deliverables. Respondents shall reimburse EPA, pursuant to Section XXIV of this Order, for all response costs (including attorney fees) incurred by the United States to obtain access for Respondents.

XX. SITE ACCESS AND DATA/DOCUMENT AVAILABILITY

71. Respondents shall allow EPA and its authorized representatives and contractors to enter and freely move about all property at the Site to which Respondents have access and which is subject

to or affected by the work under this Order or where documents required to be prepared or maintained by this Order are located, for the following purposes: inspecting conditions, activities, the results of activities, records, operating logs, and contracts related to the Work or Respondents and their representatives or contractors pursuant to this Order; reviewing the progress of the Respondents in carrying out the terms of this Order; conducting tests as EPA or its authorized representatives or contractors deem necessary; using a camera, sound recording device or other documentary type equipment; and verifying the data submitted to EPA by Respondents. Respondents shall allow EPA and its authorized representatives to enter any property within the Site area to which Respondents have access, to inspect and copy all records, files, photographs, documents, sampling and monitoring data, and other writings related to Work undertaken in carrying out this Order. Nothing herein shall be interpreted as limiting or affecting EPA's right of entry or inspection authority under Federal law.

72. Respondents may assert a claim of business confidentiality covering part or all of the information submitted to EPA pursuant to the terms of this Order under 40 C.F.R. § 2.203, provided such claim is not inconsistent with Section 104(e)(7) of CERCLA, 42 U.S.C. § 9604(e)(7) or other provisions of law. This claim shall be asserted in the manner described by 40 C.F.R. § 2.203(b) and substantiated by Respondents at the time the claim is made. Information determined to be confidential by EPA will be given the protection specified in 40 C.F.R. Part 2. If no such claim accompanies the information when it is submitted to EPA, it may be made available to the public by EPA or the state without further notice to the Respondents. Respondents shall not assert confidentiality claims with respect to any data related to conditions, sampling, or monitoring within the Site.

73. Respondents shall maintain for the period during which this Order is in effect, an index of documents that Respondents claim contain confidential business information. The index shall contain, for each document, the date, author, addressee, and subject of the document. Upon written request from EPA, Respondents shall submit a copy of the index to EPA.

XXI. RECORD PRESERVATION

74. Respondents shall provide to EPA, upon request, copies of all documents and information within their possession and/or control or that of their contractors or agents relating to activities at or near the Site or to the implementation of this Order, including but not limited to sampling, analysis, chain of custody records, manifests, trucking logs, receipts, reports, sample traffic routing, correspondence, or other documents or information related to the Work. Respondents shall also make available to EPA for purposes of investigation, information gathering, or testimony, their employees, agents, or representatives with knowledge of relevant facts concerning the performance of the Work.

75. Until six (6) years after EPA provides notice that all Work required under this Order has been completed, Respondents shall preserve and retain all records and documents in their possession or control, and shall instruct their contractors and agents to preserve and retain all records and documents in their possession or control, that relate in any manner to the Site or the Work. At the conclusion of this document retention period, Respondents shall notify the United States at least ninety (90) calendar days prior to the destruction of any such records or documents, and

upon request by the United States, Respondents shall deliver any such records or documents to EPA.

76. Within forty-five (45) after the effective date of this Order, Respondents shall submit a written certification to EPA's RPM that they have not altered, mutilated, discarded, destroyed or otherwise disposed of any records, documents or other information relating to their potential liability with regard to the Site since notification of potential liability by the United States or the State or the filing of suit against them regarding the Site. Respondents shall not dispose of any such documents without prior approval by EPA. Respondents shall, upon EPA's request and at no cost to EPA, deliver the documents or copies of the documents to EPA.

XXII. DELAY IN PERFORMANCE

77. Any delay in performance of this Order that, in EPA's judgment, is not properly justified by Respondents under the terms of this Section shall be considered a violation of this Order. Any delay in performance of this Order shall not affect Respondents' obligations to fully perform all obligations under the terms and conditions of this Order.

78. Respondents shall notify EPA of any delay or anticipated delay in performing any requirement of this Order. Such notification shall be made by telephone to EPA's RPM within forty eight (48) hours after Respondents first knew or should have known that a delay might occur. Respondents shall adopt all reasonable measures to avoid or minimize any such delay. Within five (5) business days after notifying EPA by telephone, Respondents shall provide

written notification fully describing the nature of the delay, any justification for delay, any reason why Respondents should not be held strictly accountable for failing to comply with any relevant requirements of this Order, the measures planned and taken to minimize the delay, and a schedule for implementing the measures that will be taken to mitigate the effect of the delay. Increased costs or expenses associated with implementation of the activities called for in this Order is not justification for any delay in performance.

XXIII. ASSURANCE OF ABILITY TO COMPLETE WORK

79. Respondents shall demonstrate the ability to complete the Work required by this Order and to pay all claims that arise from the performance of the Work by obtaining and presenting to EPA within 60 days after the effective date of the Order, one of the following: (1) a performance bond; (2) a letter of credit; (3) a trust agreement; (4) a guarantee by a third party; or (5) internal financial information to allow EPA to determine that one or more of the Respondents have sufficient assets available to perform the Work. Respondents shall demonstrate financial assurance in an amount to be determined by EPA. If Respondents seek to demonstrate ability to complete the remedial action by means of internal financial information, or by guarantee of a third party, Respondents shall re-submit such information annually, on the anniversary of the effective date of this Order. If EPA determines that such financial information is inadequate, Respondents shall, within thirty (30) days after receipt of EPA's notice of determination, obtain and present to EPA for approval one of the other four forms of financial assurance listed above.

80. At least seven (7) days prior to commencing any work at the Site pursuant to this Order, Respondents shall submit to EPA a certification that Respondents or their contractors and subcontractors have adequate insurance coverage or have indemnification for liabilities for injuries or damages to persons or property which may result from the activities to be conducted by or on behalf of Respondents pursuant to this Order. Respondents shall ensure that such insurance or indemnification is maintained for the duration of the Work required by this Order.

XXIV. REIMBURSEMENT OF RESPONSE COSTS

81. Respondents shall reimburse EPA, upon written demand, for all response costs incurred by the United States in overseeing Respondents' implementation of the requirements of this Order or in performing any response action which Respondents fail to perform in compliance with this Order. EPA may submit to Respondents on a periodic basis an accounting of all response costs incurred by the United States with respect to this Order. EPA's certified Superfund Cost Recovery Package Imaging and On-Line System summary report (SCORPIOS cost summary), or such other summary as certified by EPA, shall serve as the basis for payment demands.

82. Respondents shall, within thirty (30) days of receipt of each EPA accounting, remit a certified or cashier's check for the amount of those costs. Interest shall accrue from the later of the date that payment of a specified amount is demanded in writing or the date of the expenditure. The interest rate is the rate established by the Department of the Treasury pursuant to 31 U.S.C. § 3717 and 4 C.F.R. § 102.13.

83. Checks shall be made payable to the Hazardous Substances Superfund and shall include a reference to the Cooper Drum Company Superfund Site , the site identification number 091N, and Docket No. 2009-07. Checks shall be forwarded to:

U.S. Environmental Protection Agency
Superfund Payments
Cincinnati Finance Center
P.O. Box 979076
St. Louis, MO 63197-9000

84. Respondents shall send copies of each transmittal letter and check to the EPA Project Manager or other person so designated by EPA.

XXV. UNITED STATES NOT LIABLE

85. The United States, by issuance of this Order, assumes no liability for any injuries or damages to persons or property resulting from acts or omissions by Respondents, or their directors, officers, employees, agents, representatives, successors, assigns, contractors, or consultants in carrying out any action or activity pursuant to this Order. Neither EPA nor the United States may be deemed to be a party to any contract entered into by Respondents or their directors, officers, employees, agents, successors, assigns, contractors, or consultants in carrying out any action or activity pursuant to this Order.

XXVI. ENFORCEMENT AND RESERVATIONS

86. EPA reserves the right to bring an action against Respondents under Section 107 of CERCLA, 42 U.S.C. § 9607, for recovery of any response costs incurred by the United States related to this Order and not reimbursed by Respondents. This reservation shall include but not be limited to past costs, direct costs, indirect costs, the costs of oversight, the costs of compiling

the cost documentation to support oversight cost demand, as well as accrued interest as provided in Section 107(a) of CERCLA.

87. Notwithstanding any other provision of this Order, at any time during the response action, EPA may perform its own studies, complete the response action (or any portion of the response action) as provided in CERCLA and the NCP, and seek reimbursement from Respondents for its costs, or seek any other appropriate relief.

88. Nothing in this Order shall preclude EPA from taking any additional enforcement actions, including modification of this Order or issuance of additional Orders for additional remedial or removal actions as EPA may deem necessary, or from requiring Respondents in the future to perform additional activities pursuant to Section 106(a) of CERCLA, 42 U.S.C. § 9606(a), Section 7003 of RCRA, 42 U.S.C. § 6973, or any other applicable law. Respondents shall be liable under CERCLA Section 107(a), 42 U.S.C. § 9607(a), for the costs of any such additional actions under CERCLA.

89. Notwithstanding any provision of this Order, the United States hereby retains all of its information gathering, inspection and enforcement authorities and rights under CERCLA, RCRA and any other applicable statutes or regulations.

90. Respondents shall be subject to civil penalties under Section 106(b) of CERCLA, 42 U.S.C. § 9606(b), of not more than $37,500 for each day in which Respondents willfully violate, or fail or refuse to comply with this Order without sufficient cause. In addition, failure to properly provide response action under this Order, or any portion hereof, without sufficient cause, may result in liability under Section 107(c)(3) of CERCLA, 42 U.S.C. § 9607(c)(3), for punitive damages in an amount at least equal to, and not more than three times the amount of, any costs incurred by EPA as a result of such failure to take proper action.

91. Nothing in this Order shall constitute or be construed as a release from any claim, cause of action or demand in law or equity against any person for any liability it may have arising out of or relating in any way to the Site.

92. If a court issues an order that invalidates any provision of this Order or finds that Respondents have sufficient cause not to comply with one or more provisions of this Order, Respondents shall remain bound to comply with all provisions of this Order not invalidated by the court's order.

XXVII. ADMINISTRATIVE RECORD

93. Upon request by EPA, Respondents must submit to EPA all documents related to the selection of the response action for possible inclusion in the administrative record file.

XXVIII. OPPORTUNITY TO CONFER

94. EPA will hold a conference on March 5, 2009 at 1:00 pm at the Embassy Suites Hotel, Presidential/Executive Meeting Room, 8425 Firestone Blvd., Downey, California 90241 (tel. (562) 861-1900) to discuss this Order.

95. The purpose and scope of the conference shall be limited to issues involving the implementation of the response actions required by this Order and the extent to which Respondents intend to comply with this Order. This conference is not an evidentiary hearing, and does not constitute a proceeding to challenge this Order. It does not give Respondents a right to seek review of this Order, or to seek resolution of potential liability, and no official stenographic record of the conference will be made.

XXIX. EFFECTIVE DATE

96. This Order shall be effective on March 19, 2009.

So Ordered, this 10th day of February 2009.

BY: Kathleen Salyer

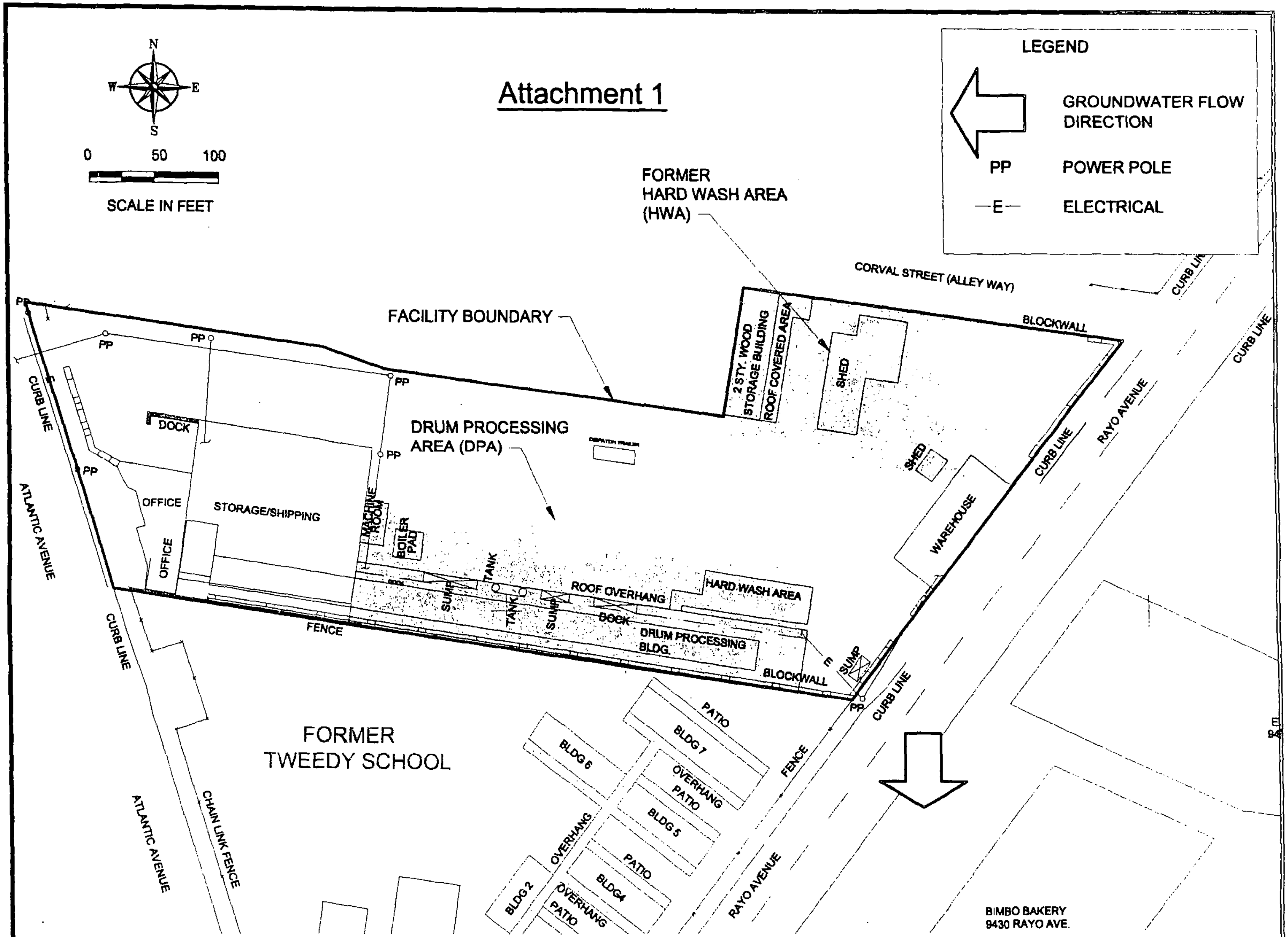
Kathleen Salyer
Assistant Director, Superfund Division
California Site Cleanup Branch
U.S. Environmental Protection Agency, Region 9

ATTACHMENT 1

TO UNILATERAL ADMINISTRATIVE ORDER 2009-07
IN THE MATTER OF A.G. LAYNE, INC., ET. AL.

SITE MAP

Attachment 1



Cooper Drum Company
South Gate, CA

Site Layout

ATTACHMENT 2

TO UNILATERAL ADMINISTRATIVE ORDER 2009-07
IN THE MATTER OF A.G. LAYNE, INC., ET. AL.

LIST OF RESPONDENTS
TO UNILATERAL ADMINISTRATIVE ORDER 2009-07

LIST OF RESPONDENTS
UNILATERAL ADMINISTRATIVE ORDER 2009-07

1. A.G. Layne, Inc.
2. Ashland, Inc.
3. Atlantic Richfield Company
4. Baker Petrolite Corporation
5. Cargill, Inc.
6. Castro Industrial North America, Inc.
7. Chemcentral Corporation
8. Chemtura Corporation
9. Chevron Corporation
10. Cooper Living Trust
11. Cooper Properties, LP
12. Coral Chemical Company
13. CRC Industries, Inc.
14 .D.A. Stuart Company
15. Dunn Edwards Corporation
16. Engineered Polymer Solutions, Inc.
17. Exxon Mobil Oil Corporation
18. Gallade Chemical, Inc.
19. G.E. Betz, Inc.
20. Hasco Oil Company
21. Houghton International, Inc.
22. J.H. Mitchell & Sons, Distributors, Inc.
23. Lockheed-Martin Corporation
24. Lonza, Inc.
25. Lubricating Specialties Company
26. Mathisen Oil Company, Inc.
27. Pennzoil-Quaker State Company
28. Penreco, Inc.
29. Petrolock, Inc.
30. Powerine Oil Company
31. Quaker Chemical Corporation
32. Rathon Corporation
33. Shell Chemical Company
34. Shell Oil Company
35. SOCO West, Inc.
36. Southern California Edison
37. Southern Counties Oil Company, LLP
38. Stuart's Petroleum Corporation
39. Texaco Refining & Marketing, Inc.
40. Union Oil Company of California
41. Univar USA, Inc.
42. Viacom, Inc.
43. Waste Management, Inc.

ATTACHMENT 3

TO UNILATERAL ADMINISTRATIVE ORDER 2009-07
IN THE MATTER OF A.G. LAYNE, INC., ET. AL.

RECORD OF DECISION

RECORD OF DECISION

COOPER DRUM COMPANY
CITY OF SOUTH GATE, CALIFORNIA

U.S. Environmental Protection Agency
Region 9
San Francisco, California

September 27, 2002

RECORD OF DECISION
COOPER DRUM COMPANY

Part I - DECLARATION

Part II - DECISION SUMMARY

LIST OF TABLES

LIST OF FIGURES

PART I THE DECLARATION

1.1 Site Name and Location

Cooper Drum Company
9316 Atlantic Avenue
City of South Gate, Los Angeles County, California 90280
CERCLIS Identification Number CAD055753370.

1.2 Statement of Basis and Purpose

This decision document presents the selected remedy for the Cooper Drum Company Superfund Site (Cooper Drum), in South Gate, California, which was chosen in accordance with Comprehensive Environmental Response, Compensation and Liability Act of 1980, as amended by Superfund Amendments and Reauthorization Act of 1986 (SARA) (collectively referred to herein as CERCLA) and to the extent practicable, the National Oil and Hazardous Substances Pollution Contingency Plan, (NCP). This decision is based on the Administrative Record file for Cooper Drum.

The State of California, acting through the California Department of Toxic Substances Control (DTSC) and the Los Angeles Regional Water Quality Control Board (LARWQCB), concur with the selected remedy.

1.3 Assessment of Site

The response action selected in this Record of Decision (ROD) is necessary to protect the public health or welfare or the environment from actual or threatened releases of hazardous substances, pollutants or contaminants from the Cooper Drum site which may present an imminent and substantial endangerment to public health or welfare.

1.4 Description of Selected Remedy

The remedial action for Cooper Drum addresses contaminated soil and groundwater. To remove the potential threat to human health, the selected remedy will use dual phase extraction (DPE) for treatment of volatile organic compounds (VOCs) in soil and perched groundwater. Other non-VOC soil contaminants, including semi-volatile organic compounds (SVOCs), PCBs, and lead, will be excavated and disposed of off site. Institutional controls will be implemented to prevent exposure to soil contaminants where excavation is not feasible. The cleanup strategy for groundwater contaminated with VOCs will use a combination of methods to achieve remedial goals and to restore the potential beneficial use of the aquifer as a drinking water source. An extraction/treatment system will be used for containment and remediation. Chemical in situ treatment will also be used to enhance the treatment of VOCs in groundwater, minimize the need for extraction, and reduce the potential for other VOC plumes in the vicinity to impact Cooper Drum.

There is no source material or non-aqueous phase liquids (NAPLs) in the groundwater constituting a principal threat at Cooper Drum. The VOCs in the soil are mobile but are low-level threats to human health since they contain relatively low contaminant concentrations and can be contained. The non-VOCs in the shallow soil are not mobile and are localized in a confined area.

The major components of the selected remedy includes the following actions:

Selected Remedy for Soil

- In the former hard wash area (HWA), extract VOC-contaminated soil vapor and groundwater simultaneously using dual phase extraction (DPE) technology. Treat the extracted soil vapor and groundwater using vapor and liquid phase carbon in vessels at an on-site treatment plant.

- After removal of VOCs, discharge the treated soil vapor into the air. The treated water will be reinjected into the aquifer or discharged to the public sewer system operated by the Los Angeles County Sanitation District.

- Conduct additional soil gas sampling in the drum processing area (DPA) during the remedial design (RD) phase to further identify the extent of VOC contamination and the need for remediation using dual phase extraction in this area.

- In the HWA and DPA, excavate an estimated 2,700 tons of non-VOC contaminated shallow soil (estimated down to five feet in depth) for disposal at an approved off-site facility. Use clean soil to backfill excavated areas.

- Conduct additional soil sampling in the DPA and HWA during the RD phase to further define the extent of non-VOC contamination and the need for remediation beyond the estimated 2,700 tons of soil.

- Implement institutional controls for soil contaminated with non-VOCs in areas where excavation is not feasible, such as under existing structures, by requiring the execution and recording of a restrictive covenant which will limit activities that might expose the subsurface and would prevent future use, including residential, hospital, day care center and school uses, as long as contaminated soil remains on site.

Selected Remedy for Groundwater

- Extract groundwater contaminated with VOCs and treat it using liquid-phase activated carbon in vessels at an on-site treatment system. Containment will be provided at the downgradient extent of contamination.

- The treated water will be reinjected into the contaminated groundwater aquifer or discharged to the public sewer system operated by the Los Angeles County Sanitation District. Reinjection will reduce the intrusion of and the potential for mixing with other off-site VOC plumes.

- Use in situ chemical treatment, either reductive dechlorination or chemical oxidation, to enhance remediation of VOC-contaminated groundwater. During the remedial design (RD) phase, conduct treatability studies to evaluate both methods and determine which works best under site conditions. Data obtained from pilot studies will also be used to determine the specific number and placement of in situ injection points.

- Conduct additional groundwater sampling during the RD phase to further define the downgradient extent of the VOC contamination.

- Conduct groundwater monitoring to evaluate the effectiveness of the remedy, the location of the plume, and that remediation goals have been met.

1.5 Statutory Determination

The selected remedy is protective of human health and the environment, complies with federal and state requirements that are applicable or relevant and appropriate to the remedial action, is cost-effective, and utilizes permanent solutions and alternative treatment technologies to the maximum extent practicable.

This remedy also satisfies the statutory preference for treatment as a principal element of the remedy (i.e., reduces the toxicity, mobility, or volume of hazardous substances, pollutants, or contaminants as a principal element through treatment).

Because this remedy may result in hazardous substances, pollutants, or contaminants in soil remaining on site above levels that allow for unlimited use and unrestricted exposure, and will take longer than five years to attain RAOs and cleanup levels, a review will be conducted within five years after initiation of the remedial action for Cooper Drum to ensure that the remedy is, or will be, protective of human health and the environment.

1.6 ROD Data Certification Checklist

The following information is included in the Decision Summary section of this Record of Decision. Additional information can be found in the Administrative Record file for Cooper Drum.

- Chemicals of concern and their respective concentrations - Page 15;

- Baseline risk represented by the chemicals of concern - Page 21;

- Cleanup levels established for chemicals of concern and the basis for these levels - Page 74;

- Conclusion that there are no source materials constituting principal threats at the site - Page 63;

- Current and reasonably anticipated future land use assumptions and current and potential future beneficial uses of groundwater used in the baseline risk assessment and ROD - Page 19;

- Potential land and groundwater use that will be available at the site as a result of the selected remedy - Page 73;
- Estimated capital, annual operation and maintenance (O&M), and total present worth costs, discount rate, and the number of years over which the remedy cost estimates are projected - Page 69; and
- Key factor(s) that led to selecting the remedy - Page 64.

1.7 Authorizing Signature

John Kemmerer, Chief
Superfund Site Cleanup Branch
U.S. Environmental Protection Agency, Region 9

9/27/02
Date

PART II THE DECISION SUMMARY

1.0 Site Name, Location, and Description

The Cooper Drum Company Superfund Site (Cooper Drum) is located at 9316 South Atlantic Avenue in South Gate, Los Angeles County, California (CERCLIS Identification Number CAD055753370). It is 10 miles south of the city of Los Angeles and approximately 1,600 feet west of the Los Angeles River (Figure 1-1). The property consists of 3.8 acres and is located in an urban area of mixed residential, commercial, and industrial uses. Cooper Drum is zoned for heavy industrial land use and has been used to recondition and recycle steel drums. Facilities include processing areas for cleaning and painting drums, storage areas, an office, a warehouse, and maintenance buildings. All buildings have concrete floors, and the entire facility was paved with asphalt in 1986.

The lead agency for Cooper Drum is the U.S. Environmental Protection Agency (EPA). The California Department of Toxic Substances Control (DTSC) and Los Angeles Regional Water Quality Control Board (RWQCB) serve as support agencies. Currently, the expected source of cleanup monies is the Superfund trust fund since the Cooper Drum Company filed for bankruptcy in 1993, and no other potentially responsible parties have been identified.

2.0 Site History and Enforcement Activities

2.1 Site History

Since 1941, Cooper Drum has been used by several companies to recondition and recycle used steel drums that once contained a variety of industrial chemicals. The Cooper Drum Company operated from 1972 to 1992, reconditioning drums with a process that consisted of flushing and stripping the drums for painting and resale. Drum process waste was collected in open concrete sumps and trenches that resulted in releases to soil and groundwater beneath the site.

A history of the site's use for reconditioning and recycling steel drums containing residual chemicals, includes the following:

- Since 1941, the northern portion of Cooper Drum has been owned and operated by drum recycling companies (the use and ownership of the southern portion of the site prior to 1971 is unknown). The Cooper Drum Company purchased both parcels and operated the facility from 1972 until 1992.

- Reconditioning activities took place within the present-day drum processing area (DPA) (see Figure 1-2) which is located in the central portion of Cooper Drum. When necessary, heavy duty cleaning called "hard washing" was performed in the northeast portion of the site [the former hard wash area (HWA)-see Figure 1-2]. Caustic fluids, generated by reconditioning and hard washing activities, and waste materials, removed from inside the drums, were collected in open concrete sumps and trenches. This led to the contamination of the soil and groundwater beneath Cooper Drum. Recent investigations have shown that most contamination at Cooper Drum can be traced to the HWA and the DPA.

- Beginning in 1987, the Cooper Drum facilities were retrofitted to provide better environmental protection. Closed-top steel tanks were installed over the sumps, and the trenches have been replaced with hard piping. The former hard wash area was closed and replaced with a new hard wash area in the DPA which also provided hard piping and secondary containment.

- The Cooper Drum Company continued to operate the facility until 1992. In 1992, the drum reconditioning business was sold to Waymire Drum Co., which operated the facility until 1996.

- Since 1996, Consolidated Drum Co. has been the drum reconditioning operator at the site. The facility has been fitted to also process plastic totes (large square containers). Consolidated Drum continues to use an above-ground enclosed system for containing liquids and wastes.

2.2 Previous Investigations and Enforcement Activities

Beginning in 1984 through 1989, several incidents involving the release of hazardous substances at the site resulted in Notice of Violations being issued to the Cooper Drum Company by the Los Angeles Department of Health Services (LADHS). The LADHS required the Cooper Drum Company to conduct investigations of soil and groundwater. In 1989, the California Department of Health Services, now known as the Department of Toxic Substances Control (DTSC), also collected soil samples from under the DPA. The studies identified the following hazardous substances in soils at or near Cooper Drum:

- Tetrachloroethylene (PCE, a cleaning solvent)
- Trichloroethylene (TCE, a cleaning solvent)
- Dichloroethylene (DCE, a by-product of TCE)
- Petroleum hydrocarbons
- Polychlorinated biphenyls (PCBs)
- Polyaromatic hydrocarbons (PAHs)
- Metals

Under the direction of the LADHS, consultants for the Cooper Drum Company excavated and removed contaminated soil from their property and from the adjacent Tweedy Elementary School, after caustic fluids leaked from trenches under the drum processing building onto school property. To assess impacts to groundwater in the uppermost aquifer beneath Cooper Drum (approximately 40 to 80 feet below ground surface), four monitoring wells were installed on site and one upgradient well off site.

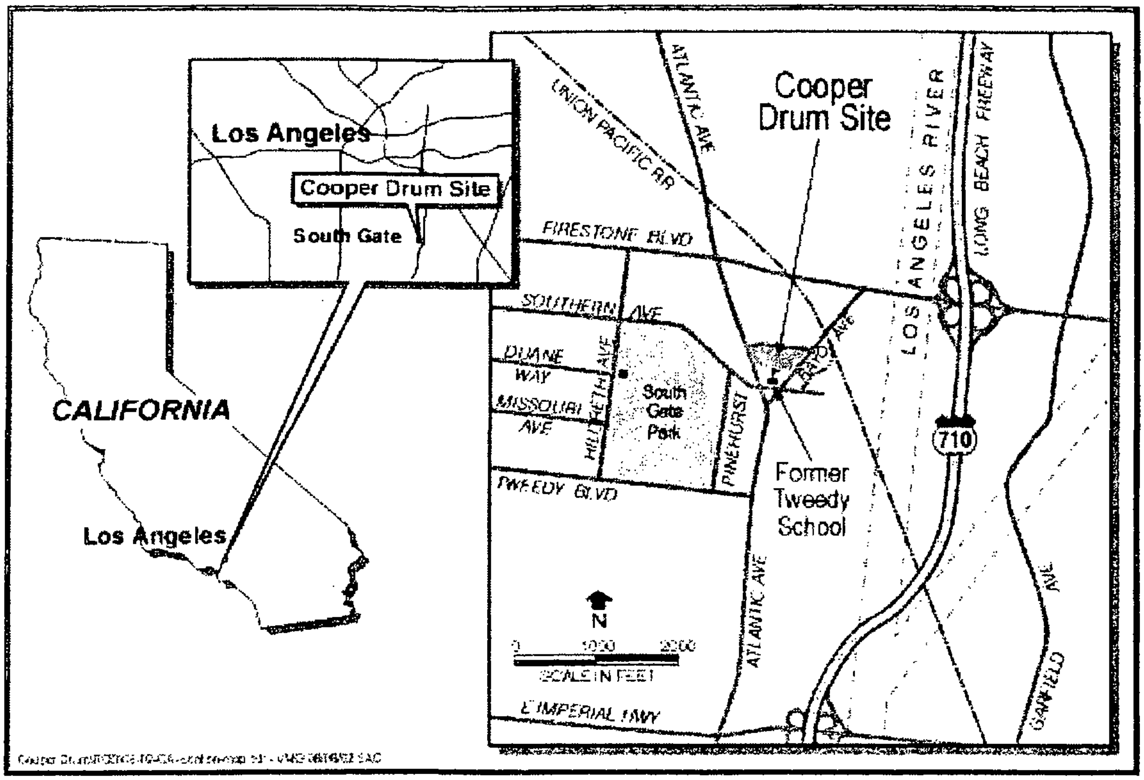


Figure 1-1. Site Location Map

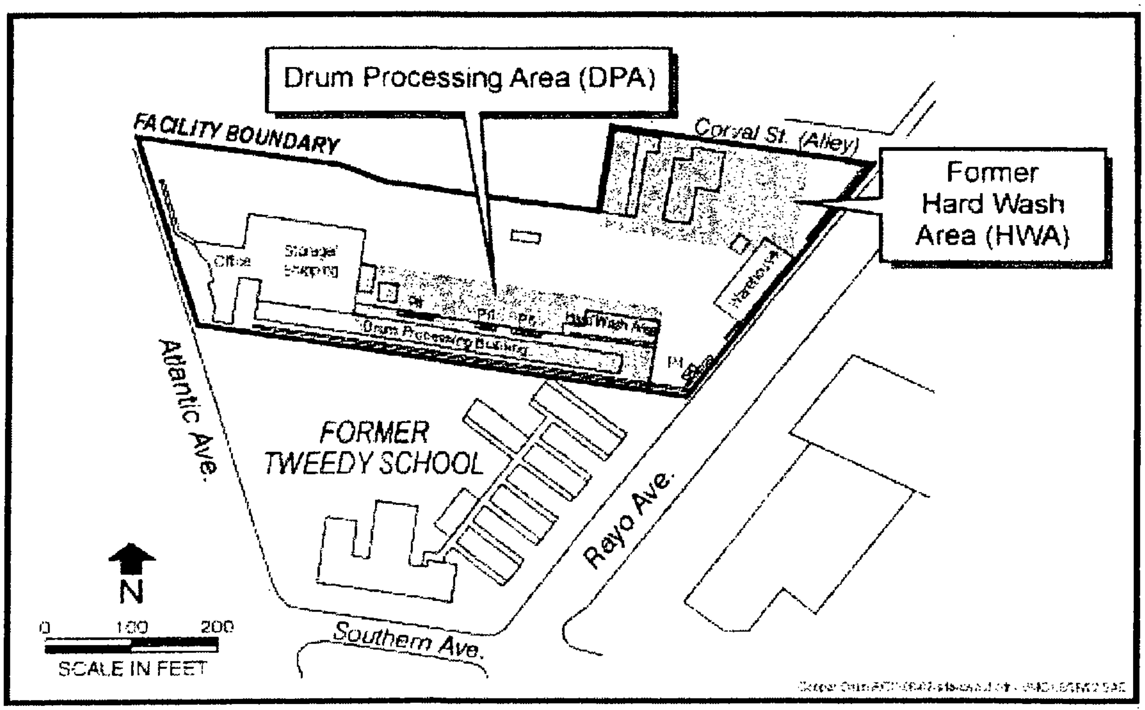


Figure 1-2. Site Layout

The groundwater beneath Cooper Drum was identified as contaminated with VOCs. In 1987, the City of South Gate closed four municipal water supply wells found to contain PCE. These wells are located in South Gate Park within 1,500 feet southwest of the site. At that time, the City listed Cooper Drum as a possible source of the PCE contamination, however, recent investigations indicate that groundwater contamination found beneath the site did not contribute to the deeper groundwater contamination affecting these municipal wells. The groundwater contamination originating from Cooper Drum is moving to the south and not toward the municipal wells. It is also confined to the upper aquifer and is not currently affecting any drinking water supplies in the City of South Gate because the municipal wells are completed in deeper aquifers.

The Tweedy School, located on the adjacent property, was closed in 1988 due to the concern that children attending the school could be exposed to contamination migrating from Cooper Drum and from other industrial operations in the area.

Based on the discovery of the soil and groundwater contamination described above, EPA first proposed Cooper Drum for inclusion on the National Priorities List (NPL) in 1992. EPA issued General Notice and 104(e) letters to Cooper Drum owners and operators at that time. During 1993, EPA met with Arthur Cooper, the site owner (and previous operator before Waymire Drum Co. took over operations in 1992) who was considered a potentially responsible party (PRP). The purpose of the meeting was to discuss the special notice letter EPA was planning to send to him and to begin negotiations for an Administrative Order on Consent (AOC) to conduct the Remedial Investigation. Later that same year, the Cooper estate declared bankruptcy upon the death of Mr. Cooper. Due to the lack of assets, the Cooper estate was no longer considered a viable PRP to help pay for Cooper Drum investigation and remediation. Consequently, Cooper Drum became a fund-lead site where Superfund trust fund money is used for site activities. Based on additional site investigation data collected by EPA, Cooper Drum was re-proposed for the NPL in January 2001. In June 2001, the EPA added Cooper Drum to the NPL of hazardous waste sites requiring remedial action.

EPA conducted the Remedial Investigation (RI) activities for Cooper Drum during 1996 to 2001. EPA initiated a soil gas survey in 1996 to identify potential hot spots (areas where contaminant concentrations of VOCs are the highest) for a Phase 1 RI. This investigation identified hot spots in the vicinity of the former HWA in the northeastern portion of the property and in the DPA in the central portion of the property. The Phase 1 RI was designed to further investigate the potential presence of VOCs, semi-volatile organic compounds (SVOCs) and metals in soil and groundwater beneath Cooper Drum and the adjacent Tweedy School property. Based on the results of the Phase 1 RI, EPA expanded its investigation of soil and groundwater to delineate the extent of contamination as part of a Phase 2 RI conducted between September 1998 and March 2001. The complete RI report was released in May 2002, and is discussed further in Section 5.0.

Nearby properties, which have also undergone investigation as sources of groundwater contamination under the direction of the LARWQCB, include the Jervis Webb site (north of Cooper Drum) and two former Dial Corporation sites (northeast and east of Cooper Drum). Data from investigations at these three sites have determined that groundwater flows in a southerly direction. High concentrations of TCE in the shallow aquifer have been detected under the Jervis Webb site (33,000 parts per billion) and in a downgradient monitoring well (6,700 parts per billion), which is located 200 feet upgradient and northeast of Cooper Drum. Due to its proximity, the groundwater contamination from Jervis Webb may already have commingled and impacted the Cooper Drum plume. The need to reduce the potential for commingling of these two plumes was an important factor considered during remedy selection.

3.0 Community Participation

During March and April 2001, EPA interviewed concerned residents, agency representatives, elected officials, and a community- based environmental justice organization. Based on these interviews, EPA prepared The Cooper Drum Community Involvement Plan which was issued in March 2002.

In May 2002, the RI/FS Report and Proposed Plan for Cooper Drum were made available to the public. These documents can be found in the Administrative Record file at the EPA Region 9 Record Center located at 95 Hawthorne Street in San Francisco and at the information repository located at the Leland R. Weaver Library at 4035 Tweedy Boulevard in South Gate, California. A Public Notice was published June 11, 2002 in the *Long Beach Press Telegram* to notify community members about the availability of the RI/FS and Proposed Plan. The Proposed Plan was also mailed to the community. The Public Notice announced the date and location for the public meeting and identified the public comment period (June 11 through July 10, 2002) for the Proposed Plan. In addition, flyers announcing the meeting were hand delivered to nearby residents and parents of children attending the relocated Tweedy Elementary School. All materials, including the Proposed Plan fact sheet, meeting presentation slides and handouts were prepared in both English and Spanish.

The public meeting for the Proposed Plan was held June 27, 2002. At this meeting, representatives from the City of South Gate Planning Department, DTSC, and EPA answered questions about the problems at Cooper Drum and the remedial alternatives. No significant comments or objections concerning the preferred remedial alternatives were raised at the meeting. Transcripts of the public meetings are part of the administrative file at the information repositories. EPA did not receive any written comments from the community during the public comment period for the Proposed Plan. The one written comment received from the California DTSC is addressed in the Responsiveness Summary in Part III.

4.0 Scope and Role of Operable Unit or Response Action

Cooper Drum contains two sources of contamination (i.e., HWA and DPA) and one groundwater plume that requires remedial action. The VOC soil contamination in the HWA appears to be the main source of contaminants found in the groundwater. The VOC soil contamination found in the DPA appears to have minimal contribution to the groundwater plume. Soil removals were conducted on the north side of the DPA in 1984, and along the south side of the DPA on the Tweedy School in 1987. No other removal or interim action was taken or is planned at Cooper Drum. Because of the relatively small area addressed in the selected remedy, dividing Cooper Drum into discrete portions, or operable units, for the purpose of managing a site-wide response action is not necessary.

The selected remedy will address soil and groundwater contamination for Cooper Drum. This response action involves control and treatment of VOC contaminants in the groundwater plume migrating from under the HWA, treatment of VOC soil contaminants in the HWA (and potentially from the DPA), and removal of the non-VOC soil contaminants at the HWA and DPA. Institutional controls will be implemented to limit exposure to any contaminated soil left on site.

5.0 Site Characteristics

5.1 Conceptual Site Model

The conceptual site model (CSM), presented on Figure 5-1, is based on the following exposure pathways: 1) Ingestion, dermal contact, and inhalation of groundwater contaminants; 2) Ingestion and direct contact with surface and subsurface soil; 3) Inhalation of airborne contaminants in outdoor air originating from soil; and 4) Inhalation of indoor air contaminants originating from soil and groundwater contamination. The receptors include future on-site and off-site residents, construction workers, and occupational workers. Assumptions applied to these pathways include: 1) pavement, concrete, buildings, and other existing cover could be removed to expose the underlying soil and 2) groundwater wells would be completed in the shallow aquifer underneath Cooper Drum and the water would be used as an untreated drinking water source. The deeper drinking water aquifers underlying Cooper Drum have not been impacted by contamination above drinking water standards; however the potential exists that contamination could migrate downward into these aquifers and adversely impact municipal water supplies. The concentration levels of soil and groundwater contaminants used in the risk assessment are based on the average (95% upper confidence limit) or the maximum concentrations detected during the RI activities. There are no ecological habitats or ecological exposures at Cooper Drum. The exposure pathways depicted in the CSM are discussed further in Section 7.1.2.

5.2 Overview of Cooper Drum

The majority of the 3.8 acre Cooper Drum property is developed for heavy industrial use, is mostly covered with asphalt or concrete, and is relatively flat with a gradual slope toward the southeast.

The property is located approximately 1,600 feet west of the Los Angeles River, which is concrete lined and flows south to southwest approximately 15 miles to the Pacific Ocean. Stormwater flows toward several drains and into the municipal stormwater system, which discharges to the Los Angeles River.

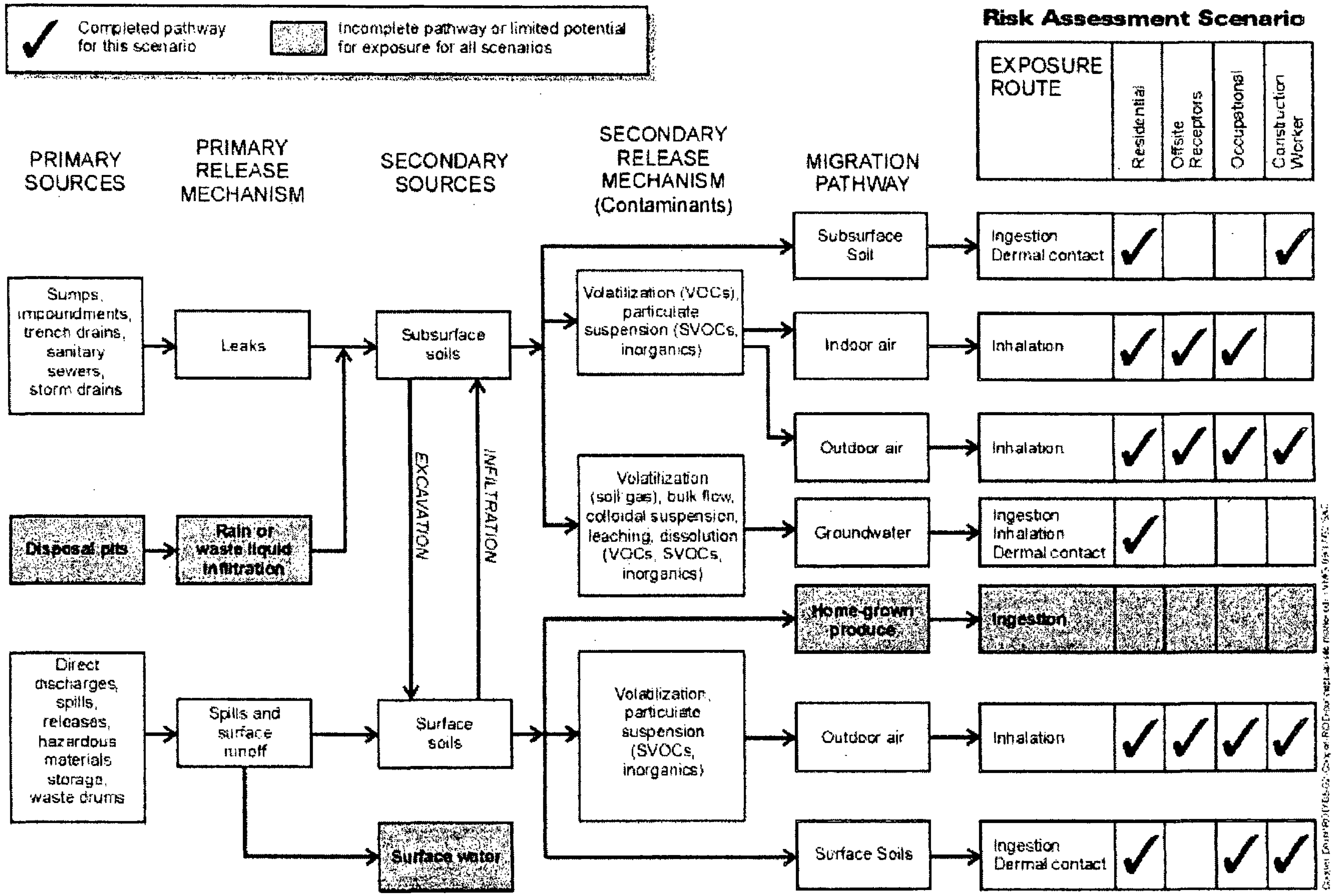


Figure 5-1. Conceptual Site Model for Cooper Drum Company Site

5.3 Surface and Subsurface Features

Open structures for recycling activities are located along the southern and northeastern property boundaries. A closed warehouse, which provides storage of equipment, is located on the eastern boundary. The majority of Cooper Drum is open and provides storage for drum and totes. A closed office building is located on the western property boundary. There are no known areas of archaeological or historical features at Cooper Drum. The subsurface aquifers beneath the site are described in section 5.7.2.

5.4 Sampling Strategy

Prior to 1996, soil sampling was performed mostly in and around the DPA with some borings located in the HWA. Four wells were installed on site (MW-1 and MW-4 in the DPA and MW-2 and MW-5 in the HWA) and one well upgradient (MW-3). All wells were completed to approximately 80 feet below ground surface (bgs) into the shallow aquifer. In 1996, EPA performed a site-wide passive soil gas survey. The VOC hot spots were subsequently investigated as part of the RI activities beginning in 1998.

The RI activities conducted in 1998 included: 1) soil sampling (down to 40 feet) and depth-discrete groundwater sampling (down to 200 feet) in borings SB-1 through SB-5; 2) sampling of the five existing on-site monitoring wells (MW-1 through MW-5); 3) soil logging and depth-discrete groundwater sampling (down to 120 feet) from four CPT borings (CPT-1 through CPT-4) located east of the site; and 4) sampling of four existing monitor wells on the ELG Metals property located east of Cooper Drum. The ELG Metals property wells are located further east of CPT-1 through CPT-4 and were sampled to confirm historical sample results and provide a data set consistent with the Phase 2 RI data to evaluate VOC distribution east of Cooper Drum.

Based on the results from the above-described field activities, additional RI activities were completed in March, April, and May 1999 including: 1) soil logging and depth discrete groundwater sampling from six CPT borings (CPT-5 through CPT-10); 2) installation and aquifer testing of one groundwater monitor/extraction well (EW-1); 3) sampling of six soil gas boring locations (SG-1 through SG-6) located in the HWA and DPA. Four of the CPT borings were located east and southeast of Cooper Drum to further delineate the extent of groundwater contamination. Well EW-1 was installed along the eastern boundary of Cooper Drum adjacent to Rayo Avenue. The well was installed to evaluate the extent of groundwater contamination along the eastern property boundary. Soil gas samples were sampled at approximately 10-foot sample intervals to 45 feet bgs to evaluate VOC vadose zone contamination in suspected source areas.

Additional RI activities were conducted between October 2000 and March 2001 and discussed below. Ten shallow borings (SB-8 to SB-17) were sampled to approximately 10 feet bgs. Five borings (SB-8 through SB-12) were located in the former HWA, and four borings (SB-13 through SB-16) were located around the drum processing building to assess VOC and non-VOC soil conditions. Eleven soil vapor borings (SG-7 to SG-17) were sampled to a depth of approximately 35 feet bgs in the vicinity of former HWA and the drum processing building to further delineate vadose contamination observed in the soil gas samples collected during the 1999 field investigations.

Fourteen cone penetrometer borings (CPT-11 through CPT-24) were logged and sampled to a minimum depth of 120 feet bgs to further delineate the extent of impacted groundwater. Six new groundwater monitoring wells (MW-15 to MW-19 and EW-2) were installed and sampled. One well was on site and five were off site. The on-site well, EW-2, was completed in the shallow aquifer to approximately 80 feet and was designed as a groundwater extraction well. The other five wells were completed along Rayo Avenue in the shallow aquifer to define the lateral extent of groundwater contamination. Two of the off-site wells, MW-16 and MW-18, were completed to a total depth of approximately 130 feet bgs in the top of the Exposition Aquifer to define the vertical extent of groundwater contamination. Groundwater samples were also collected from six existing on-site wells (MW-1, MW-2, MW-3, MW-4, MW-5, and EW-1) and four off-site wells (MW-8, MW-10, MW-12, and MW-14). An eight-hour aquifer pump test was performed on EW-2 to aid in determining remedial alternatives. One soil vapor well (SVE-1) and two sets of soil vapor monitoring points (VP-1 and VP-2) were sampled, tested, and installed in the former HWA. Performance of the soil vapor extraction test was used to evaluate remedial alternatives.

5.5 Known and Suspected Sources of Contamination

The RI investigation confirmed that waste collected in open concrete sumps and trenches resulted in releases to soil, and that migration of some of these contaminants impacted the shallow aquifer beneath Cooper Drum. The primary source area of contamination was the HWA, where drum processing operations took place until 1976 when they were moved to the DPA on the south side of the property. The DPA also became a source of contamination due to chemical spills that were documented during the 1980's. Beginning in 1987, the Cooper Drum facilities were upgraded to prevent any further release of chemical wastes and to meet environmental regulations. The former hard wash area was closed and replaced with a new hard wash area in the DPA. The location of the former HWA and DPA are shown on Figure 1-2.

5.6 Types of Contamination and Affected Media

Operations at Cooper Drum have resulted in the discharge of contaminants to the vadose zone and the underlying groundwater. Although a variety of chemicals have been released to Cooper Drum, VOCs are the chemicals that are found in both the vadose zone and groundwater. VOCs and non-VOCs have been found in the vadose zone.

The principal chemicals of concern (COCs) identified for the groundwater pathway are 1,2,3-trichloropropane (TCP), TCE, and 1,2-dichloroethane (1,2-DCA). Eight other COCs contributing to the overall risk are vinyl chloride (VC), 1,2-dichloropropane (1,2-DCP), 1,1-dichloroethane (1,2-DCA), 1,1-DCE, cis-1,2-dichloroethene (cis-1,2-DCE), PCE, trans-1,2-dichloroethene (trans-1,2-DCE), and benzene. The groundwater plume is characterized by high levels of cis-1,2-DCE and TCE. Arsenic and metals found in groundwater at concentrations exceeding drinking water standards are considered to be naturally occurring.

The principal VOC contaminants for the soil pathway are the same 11 VOCs listed above for groundwater. The non-VOCs for the soil pathway are benzo(a)pyrene, along with PCBs (Aroclor-1260 and Aroclor-1254), lead, benzo(b)fluoranthene, dibenz(a,h)anthracene, benzo(a)anthracene, benzo(k)fluorathene, chrysene, and indeno(1,2,3-cd)pyrene. Exposure to contaminants in indoor air, by on-site or off-site workers and residents, also represents a likely exposure pathway evaluated in the risk assessment summarized in Section 7.0. This scenario assumes no pavement on the property, although currently the property is paved. Soil lead concentrations of 1,920 to 3,240 mg/kg were detected in subsurface and surface soils. The COCs for Cooper Drum are summarized in Table 5-1.

Table 5-1
Types and Characteristics of Contaminants of Concern (COCs)

Contaminant (VOCs)	Source	Medium	Maximum Concentration Soil (mg/kg)	Maximum Concentration Ground water (μg/L)	Frequency of Detection Soil (mg/kg)	Frequency of Detection Groundwater (μg/L)	Mobility	Carcinogenic
Benzene	Former HWA Activities	Soil/ Groundwater	0.02	30	10/70	23/34	High	Yes
1,1-Dichloroethane (1,1-DCA)	Breakdown product	Soil/ Groundwater	0.23	340	17/70	26/35	Very high	Yes
1,1-Dichloroethene (1,1-DCE)	Breakdown product	Soil/ Groundwater	0.014	54	6/70	23/53	High	No
1,2,3-trichloropropane	Breakdown product	Soil/ Groundwater	0.044	50	1/6	20/31	High	Yes
1,2-Dichloroethane (1,2-DCA)	Breakdown product	Soil/ Groundwater	0.039	100	3/70	32/32	Very high	Yes
1,2-Dichloropropane (1,2-DCP)	Breakdown product	Soil/ Groundwater	0.019	50	3/70	24/34	High	Yes
cis-1,2-Dichloroethene (c-1,2-DCE)	Breakdown product	Soil/ Groundwater	1.1	1,200	17/64	31/33	Very high	No
Tetrachloroethene (PCE)	Former HWA Activities	Soil/ Groundwater	8.2	57	22/70	15/36	High	Yes
trans-1,2-Dichloroethene (t-1,2-DCE)	Breakdown product	Soil/ Groundwater	0.005	46	5/70	23/32	Very high	No
Trichloroethene (TCE)	Former HWA Activities	Soil/ Groundwater	0.16	800	18/70	30/34	High	Yes
vinyl chloride	Breakdown product	Soil/ Groundwater	N/A	15	N/A	25/33	Very high	Yes

Table 5-1
Types and Characteristics of Contaminants of Concern (COCs)

Contaminant (non-VOCs)	Source	Medium	Maximum Concentration		Frequency of Detection		Mobility	Carcinogenic
			Soil (mg/kg)	Ground water (µg/L)	Soil (mg/kg)	Groundwater (µg/L)		
Aroclor-1254	Unknown	Soil	1.4	N/A	6/14	N/A	Low	Yes
Aroclor-1260	Unknown	Soil	5.5	N/A	6/14	N/A	Low	Yes
Benzo(a)pyrene	Unknown	Soil	4.3	N/A	3/13	N/A	Low	Yes
Benzo(b)fluoranthene	Unknown	Soil	6.6	N/A	3/13	N/A	Low	Yes
Benzo(k)fluoranthene	Unknown	Soil	4.6	N/A	3/13	N/A	Low	Yes
Chrysene	Unknown	Soil	4.7	N/A	4/47	N/A	Low	Yes
Dibenz(a,h)anthracene	Unknown	Soil	1.1	N/A	3/13	N/A	Low	Yes
Indeno(1,2,3-cd)pyrene	Unknown	Soil	2.1	N/A	4/13	N/A	Low	Yes
Lead	Former HWA Activities	Soil	3,240	N/A	11/12	N/A	Low	No

5.7 Location of Contamination and Potential Routes of Migration

5.7.1 Soil Contamination

Eleven VOCs were identified as COCs in soil with the potential for vertical migration to the aquifer underlying Cooper Drum. Investigations have shown that most contamination at Cooper Drum originated from the HWA and the DPA. The HWA is contaminated with soil gas concentrations in excess of 1,000 parts per billion by volume (ppbv) and extends approximately 200 feet north to south and 150 feet east to west. The DPA area of soil contamination is shallower and not as laterally extensive. There are data gaps with respect to the lateral and vertical extents of VOCs beneath the drum processing building. Further delineation of contaminants beneath the DPA will be performed as part of the remedial design.

Ten non-VOCs, including polycyclic aromatic hydrocarbons (PAHs), PCBs, and lead were identified as COCs in soil. These contaminants, found in shallow soil samples beneath the DPA and HWA, are not migrating off site or to other media. The lateral and vertical extents of non-VOCs in the HWA and DPA will require further delineation during the remedial design. Based on existing data, the total volume of soil contaminated with non-VOCs has been estimated to be approximately 2,300 cubic yards. Several metals and arsenic were investigated and considered to be naturally occurring, based on statistical testing and comparison to background studies in available literature.

5.7.2 Groundwater Contamination

One of the affected media at Cooper Drum is groundwater in the shallow aquifer. The groundwater plume from Cooper Drum is estimated to be 800 feet long and 250 feet wide and extends approximately 400 feet southeast of the Cooper Drum boundary (see Figure 5-2). Investigations have not detected DNAPLs in soil or groundwater at Cooper Drum. The groundwater flow direction beneath the former HWA in the northeast portion of Cooper Drum (i.e., the source area of contamination) is to the southeast. East of Cooper Drum along Rayo Avenue, the groundwater flow direction is southerly.

The estimated lateral and vertical extent of VOCs (based on TCE concentrations) in the shallow aquifer at Cooper Drum is presented in Figure 5-2. A generalized geologic cross section showing the water- bearing units and vertical extent of groundwater contamination is also shown on Figure 5-2. Shallow groundwater beneath Cooper Drum occurs within or is controlled by an area of lower permeability, the near surface Bellflower Aquiclude, which incorporates a perched aquifer. The perched aquifer is present in the HWA at approximately 35 feet bgs and is at least 5 feet thick. The perched aquifer has been observed to be intermittent and the lateral extent has not been confirmed. The Bellflower Aquiclude extends to a depth of approximately 70 feet bgs, where it overlies the Gaspur Aquifer, which extends to a depth of approximately 110 feet bgs. Groundwater contamination above drinking water standards has been found only down to the shallow Gaspur Aquifer. Finer-grained material (clays and silts) are present within the upper portion of the Bellflower Aquiclude and the lower portion of the Gaspur Aquifer which has minimized the vertical migration of VOCs down into the Exposition and deeper aquifers which are used for drinking water.

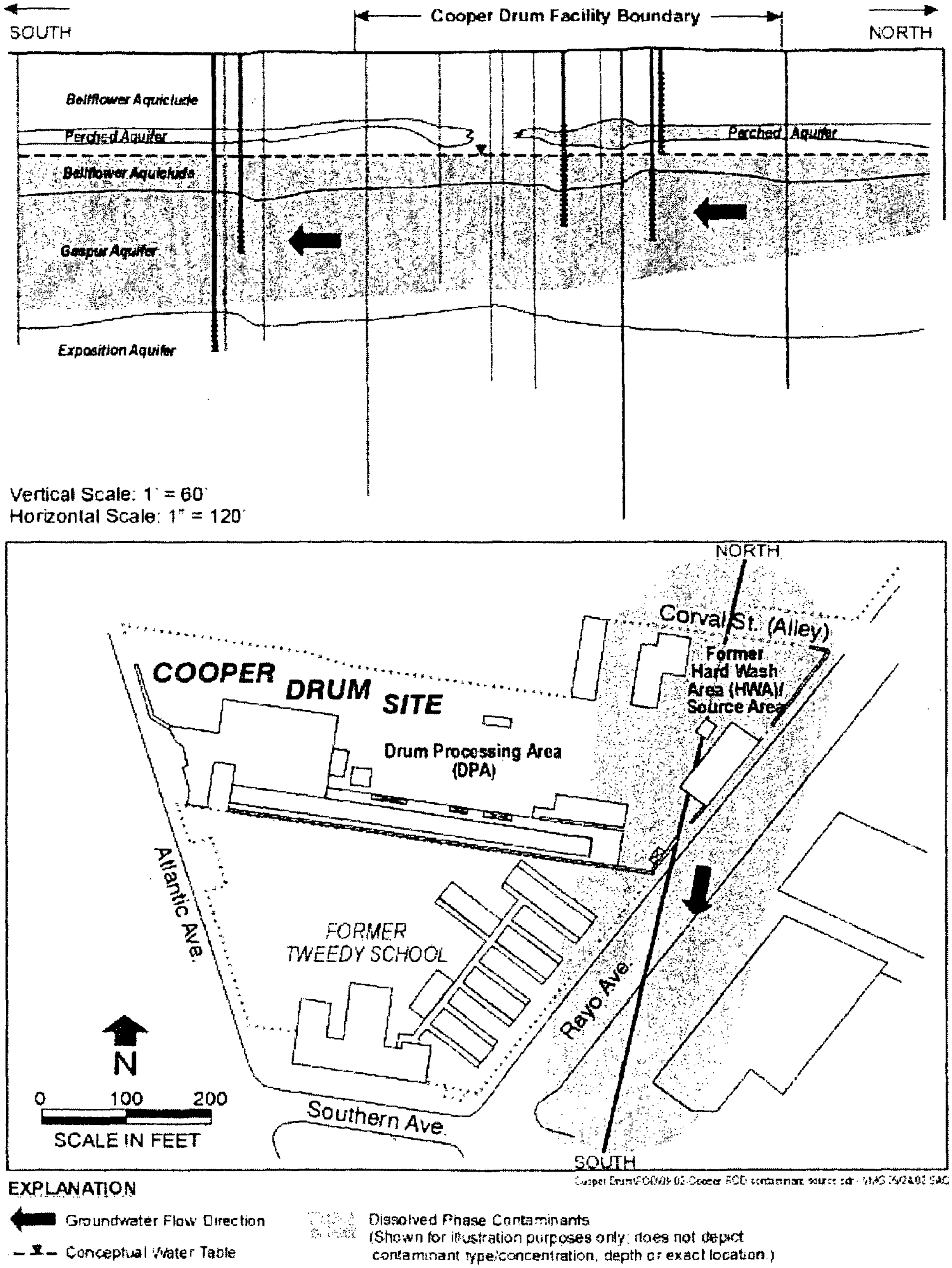


Figure 5-2. Extent of Groundwater Contamination

Municipal groundwater production wells in the vicinity of Cooper Drum draw water from the Gage Aquifer, the deepest of the Lakewood Formation aquifers at approximately 300 feet bgs, as well as from deeper aquifers within the San Pedro Formation. The Exposition Aquifer is the uppermost unit of the deeper aquifer system, and underlies the Gaspur Aquifer. The Exposition Aquifer is one of four water-bearing units within the Upper Pleistocene Lakewood Formation.

The RWQCB has identified the shallow aquifer as a potential source of drinking water and there is a potential for vertical migration of VOC into the deeper aquifer system and production wells. A generalized geological cross section of the deeper aquifer system, including production wells, is shown on Figure 5-3.

6.0 Current and Potential Future Site and Resource Uses

Cooper Drum is located in a dense urban land use setting of mixed residential, commercial, and industrial parcels. The surrounding land uses are anticipated to be of mixed urban uses in the future. The ongoing drum processing operations at Cooper Drum are considered to be a heavy industrial use for which the property is currently zoned. According to its Community Development Department, the City of South Gate is currently in the process of developing a General Plan update (the Plan) in which it is reevaluating land use designations and development options for the next 10 to 15 years within the city. The Plan is expected to be adopted by the summer of 2003. New zoning restrictions would then be enacted to conform with any changes made to land use designations in the Plan.

Future reasonably anticipated land use options for Cooper Drum include light industrial and high density commercial. Current drum processing operations could continue under a "grandfather rule" which allows for non-conforming status as long as operations are not expanded. Due to the proximity to the area where a regional high speed rail corridor may be built, it is also possible that future development for residential housing could be considered for Cooper Drum. This could occur only after the selected remedy for soil is completed and all contaminated soil above cleanup levels is removed from Cooper Drum.

The contaminated groundwater under Cooper Drum is semi-confined in the upper aquifer and characterized as shallow groundwater of poor quality water. Although the upper aquifer is not currently used as a drinking water source, it is designated by the RWQCB in the Water Quality Control Plan for the Los Angeles Region (Basin Plan) as having a potential beneficial use for drinking water. There are no other current or potential beneficial uses associated with groundwater under Cooper Drum. The potential for on-site residential land use, which includes groundwater at Cooper Drum as a drinking water source, is the most conservative scenario used as a basis for reasonable exposure assessment assumptions and risk characterization conclusions discussed in Section 7.0.

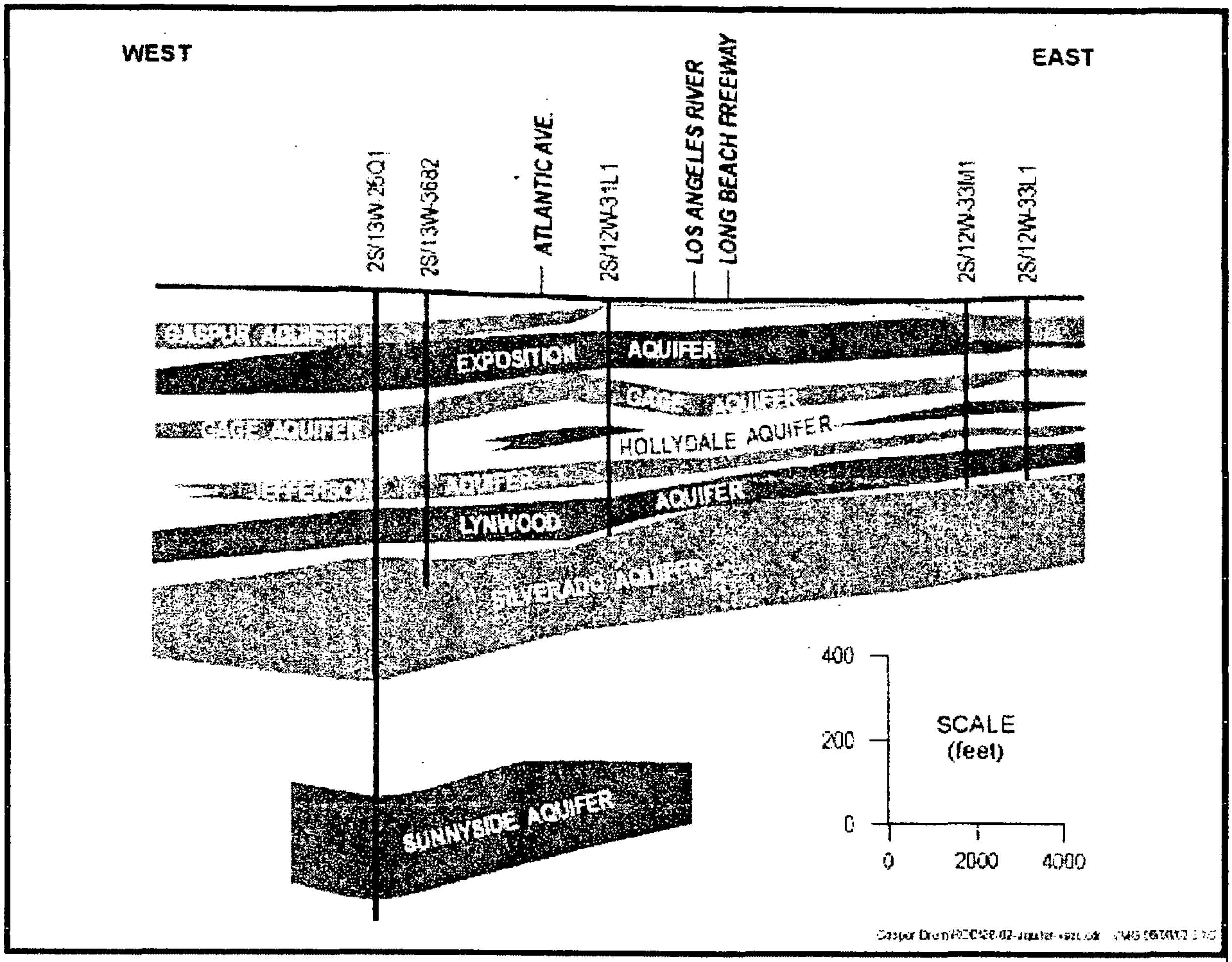


Figure 5-3. Deep Aquifer System and Production Wells

7.0 Summary of Site Risks

EPA completed a Human Health Risk Assessment (HHRA) for Cooper Drum in 2002 (URS, 2002). The HHRA estimates the human health and environmental risks that Cooper Drum could pose if no action were taken. It is one of the factors that EPA considers in deciding whether to take actions at a site. For Cooper Drum, EPA's decision to take action is based principally on the presence of contamination in groundwater at levels that exceed drinking water standards, evidence that contamination will continue to migrate into groundwater areas that are presently clean or less contaminated, and the potential use of groundwater in and around Cooper Drum as a source of drinking water. The risk assessment is also used to identify the contaminants and exposure pathways that need to be addressed by the remedial action. This section of the ROD summarizes the results of the HHRA for Cooper Drum which can be found in the Cooper Drum RI/FS Report, Appendix L (URS, 2002).

7.1 Summary of Human Health Risk Assessment

This summary of health risk includes sections on the identification of contaminants of concern (COCs), the exposure assessment, toxicity assessment, and risk characterization.

7.1.1 Identification of Contaminants of Concern

The COCs driving the need for remedial action (risk drivers) are based on the data collected during the remedial investigation (RI) between 1996 and 2001. Sampling data were available from 11 groundwater wells and 17 soil borings sampled during this period. A total of 11 VOCs detected in the groundwater and soil contributed significantly to the estimated risks and are considered COCs. A total of 10 non-VOCs detected in the soil contributed significantly to the estimated risks and are considered site COCs. The concentrations of COCs found to pose potential threats to human health in the soil and groundwater at Cooper Drum are presented in Tables 7-1a to 7-1d. The tables also identify the exposure point concentrations (EPCs) for soil and groundwater, ranges of concentrations detected for each COC, the detection frequency (i.e., the number of times the chemical was detected in the samples collected at Cooper Drum), and how the EPC was derived. As shown in the tables, TCE and cis-1,2-DCE in groundwater are the most frequently detected COCs at Cooper Drum and have the highest EPCs. Lead in soil is the most frequently detected soil COC and also has the highest EPC. The principal COCs for the groundwater pathway are 1,2,3-trichloropropane, TCE, 1,2-DCA, and vinyl chloride. Other COCs contributing to the overall risk include 1,1-DCA, benzene, 1,2-dichloropropane, and PCE. The principal COC for the soil pathway is benzo(a)pyrene, with the PCB, Aroclor-1260, lead, benzo(b)fluoranthene, and dibenz(a,h)anthracene also contributing.

7.1.2 Exposure Assessment

Exposure refers to the potential contact of an individual (receptor) with a chemical. Exposure assessment is the determination or estimation of the magnitude, frequency, duration, and route of potential exposure. This section briefly summarizes the potentially exposed populations, the exposure pathways evaluated, and the exposure quantification from the HHRA performed for Cooper Drum.

A complete discussion of all the scenarios and exposure pathways is presented in the Cooper Drum RI/FS Report, Appendix L (URS, 2002) and is summarized in the following discussion and depicted in the Cooper Drum conceptual model (CSM) included as Figure 5-1.

As depicted in the CSM, the following pathways for current and future receptors were considered complete based on the presence of all four pathways and the nature of Cooper Drum, as well as the assumption that pavement, concrete, buildings, and other existing cover could be removed to expose the underlying soil.

- **Ingestion and direct contact with surface soil** (2 feet or less bgs) for on-site occupational workers, and shallow and deeper subsurface soils (0 to 12 feet bgs) for the hypothetical future on-site resident (adult and child) and construction worker;

- **Inhalation of airborne contaminants in outdoor air** (VOCs and particulate matter from subsurface and surface soils) for on- and off-site residents, occupational workers, and on-site construction workers;

- **Inhalation of indoor air contaminants in soil and groundwater** (particulate matter from surface and subsurface soils and VOCs from soils and groundwater) for on- and off-site residents and indoor occupational workers; and

- **Ingestion, dermal contact, and inhalation of groundwater contaminants** for domestic usage (washing, bathing, laundry, etc.) and as a potable drinking water supply for potential on-site and off-site residents (i.e., untreated water supply).

It should be noted that the assumption that residents could be exposed to contaminated groundwater from Cooper Drum is highly conservative. Contamination at Cooper Drum has not affected drinking water sources in the South Gate area. There are currently no wells providing a public drinking water supply from the contaminated shallow aquifer in the area of Cooper Drum. Further, regulations, such as the Safe Drinking Water Act, prohibit water purveyors from serving water contaminated in excess of drinking water standards (MCLs) to consumers.

7.1.3 Toxicity Assessment

Tables 7-1a to 7-1d show the 21 COCs that are the major risk contributors for Cooper Drum. Based on data from USEPA (IRIS), Cal/EPA (OEHHA) and other published data, of the 21 COCs two are classified as human carcinogens (EPA weight-of-evidence Class A), 12 are classified as probable human carcinogens (EPA weight-of-evidence class B2), three are possible human carcinogens, and the remaining four are noncarcinogenic. The carcinogenic oral/dermal and inhalation slope factors for the 17 carcinogenic COCs are presented in Table 7-2.

In addition to their classification as human carcinogens, 12 COCs have toxicity data indicating their potential for adverse noncarcinogenic health effects. The chronic toxicity data available for these compounds have been used to develop oral and inhalation reference doses (RfDs). The RfD represents a level that an individual may be exposed to that is not expected to cause any deleterious effect. The oral and inhalation RfDs are presented in Table 7-3. For complete information on toxicity of each chemical, see the Cooper Drum RI/FS Report, Appendix L (URS, 2002).

The following hierarchical approach is used to determine toxicity values:

- California Cancer Potency Factors (CPFs) developed by the California Environmental Protection Agency's (Cal/EPA's) Office of Environmental Health Hazard Assessment (OEHHA) (Cal/EPA 2001);

- EPA's Integrated Risk Information System (IRIS) database for toxicity value (i.e., noncarcinogenic RfDs, and carcinogenic SFs) (EPA 2000b);

- Chronic RfDs promulgated into California regulations, or used to develop environmental criteria that are promulgated into regulations; and

- Current edition of EPA's Health Effects Assessment Summary Tables (HEAST) (EPA 1997b).

7.1.4 Risk Characterization

This section presents the results of the evaluation of the potential risks to human health associated with exposure to contaminated soil and groundwater at Cooper Drum.

For carcinogens, risks are generally expressed as the incremental probability of an individual developing cancer over a lifetime as a result of exposure to site-related contaminants. These risks are probabilities that are expressed in scientific notation (e.g., 1e-06). An excess lifetime cancer risk of 1e-06 indicates that an individual has a 1 in 1,000,000 chance of developing cancer as a result of site-related exposure. This is referred to as an "excess lifetime cancer risk" because it would be in addition to the risks of cancer individuals face from other causes. The chance of an individual developing cancer from all other causes has been estimated to be as high as 1 in 3. EPA's generally acceptable risk range for site-related exposures is 1e-04 to 1e-06 (in effect, 1 in 10,000 to 1 in a 1,000,000). An excess lifetime cancer risk greater than 1 in 10,000 (1e-04) is the point at which action is generally required at a site (EPA 1991a).

The potential for noncarcinogenic effects is evaluated by comparing an exposure level, over a specified time period, with a reference dose (RfD), based on an average daily exposure or dose. The ratio of the dose to the RfD is referred to as the hazard quotient (HQ). An HQ less than one indicates that a receptor's dose is less than the RfD and that adverse toxic noncarcinogenic effects from exposure to that chemical are unlikely. The sum of all of the chemical and route-specific HQs is called the hazard index (HI). An HI less than one indicates that noncarcinogenic effects from all the contaminants are unlikely.

Conclusions

Tables 7-4 and 7-5 present the risk characterization summaries for carcinogenic and noncarcinogenic effects, respectively. The risk estimates presented in these tables are based on reasonable maximum exposure (RME) scenarios and were developed by taking into account various conservative assumptions about the frequency and duration of exposure to soil and groundwater, as well as the toxicity of the COCs. The results are summarized in the following paragraphs for the three exposure pathways (groundwater, soil, and indoor air).

The cumulative (soil, groundwater, indoor air) excess carcinogenic risk for the future resident at Cooper Drum is estimated at 3.4e-02 with a non-carcinogenic HI of 193. The groundwater contaminants 1,2,3-TCP, TCE, and 1,2-DCA are the principal risk drivers. TCE, 1,2-DCA, cis-1,2-DCE, and 1,2-DCP are the principal non-carcinogenic COCs driving the elevated HI. The hazards presented by these risk drivers are based on a hypothetical future on-site residential exposure to these COCs through ingestion and inhalation of water from an untreated groundwater supply at Cooper Drum. A response action is generally warranted if the cumulative excess carcinogenic risk to an individual exceeds 1e-04, or the non-carcinogenic HI value is greater than one.

The cumulative excess carcinogenic risk resulting from exposure to soil contaminants for a future resident at Cooper Drum is estimated at 3.4e-04, with an non-carcinogenic HI of 3. The principal carcinogenic risk drivers are benzo(a)pyrene, PCB (Aroclor-1260 and Aroclor-1254), benzo(b)fluoranthene, dibenz(a,h)anthracene, and PCE. The principal non-carcinogenic risk driver is Aroclor 1260. The exposure pathways primarily driving the risks include soil ingestion and dermal contact. In addition, the potential for elevated blood lead levels for the future resident and construction worker were evaluated. The results indicate that exposure to lead from on-site soils could result in elevated blood lead levels above the threshold value of 10 µg/dL.

Chemical-specific standards that define acceptable risk levels are also exceeded in groundwater at Cooper Drum when that groundwater is designated as a potential source of drinking water. Except for 1,2,3-TCP, the California and federal drinking water standards, or maximum contaminant level (MCL), were exceeded by all of the groundwater COCs. An enforceable drinking water standard for 1,2,3-TCP has not been promulgated. Additionally VOCs in soil and soil gas were evaluated using a computer model to estimate contaminant transport through the soil. The model results also indicate that VOCs in soil pose a health threat by leaching to groundwater and exceeding drinking water standards.

<u>Groundwater.</u> The exposure pathways and scenarios driving the health risks are the groundwater pathways (ingestion, inhalation, dermal contact) for the future resident. The carcinogenic risk drivers are 1,2,3-TCP (3e-02), TCE (7e-04), and 1,2-DCA (7e-04). Several other COCs, including VC (6e-04), 1,2-DCP (3e-04), and benzene (3e-04), also contribute to the high risks, but 1,2,3-TCP at concentrations detected in the on-site monitoring wells is the primary COC. Most of the risk is attributed to exposure through the inhalation (3e-02) and ingestion route (6e-03).

The noncarcinogenic risk drivers for the residential child are TCE (HI = 48), cis-1,2-DCE (HI = 45), 1,2-DCA (HI = 21), and 1,2-DCP (HI = 16). Ingestion and inhalation contribute almost equally to the estimated HI value resulting in respective route-specific HI values of 62 and 123.

Soil Pathway. Although several orders of magnitude below groundwater health risks, exposure to soil COCs constitute high risks. The estimated total excess lifetime cancer risks for the hypothetical on-site resident exposed to COCs in on-site soils is 3.3e-04. The principal risk driver is benzo(a)pyrene (1e-04), along with Aroclor-1260 (6e-05), benzo(b)fluoranthene (2e-05), dibenz(a,h)anthracene (2e-05), Aroclor-1254 (2e-05), and PCE (1e-05). The exposure pathways primarily driving the need for action include soil ingestion (2e-04) and dermal contact (8e-05).

The estimated potential health hazard HI for the future on-site residential child exposed to the soil COCs is 3.0. The potential health hazard is primarily attributed to soil ingestion of PCB, Aroclor-1254, (HI = 2). Also, exposure to lead concentrations of 1,920 to 3,240 mg/kg detected in subsurface and surface soils could result in elevated blood lead levels above the threshold level of 10 µg/dl, thereby posing a potential health risk to both the future resident and construction worker.

Indoor Air Pathway. The indoor air risks for the hypothetical resident and indoor occupational worker were based on actual soil, soil gas, and groundwater data, with the indoor air EPCs estimated using the Johnson and Ettinger model for subsurface vapor intrusion into buildings. The risks for the hypothetical residential receptor constitute high risks approaching one in one thousand (1e-03), primarily as a result of exposure to 1,2,3-TCP (6.1e-04), PCE (3.1e-04), and vinyl chloride (5e-05). For the indoor occupational worker, the risks were nearly as high at 2e-04, again due primarily as a result of exposure to 1,2,3-TCP (1e-04), PCE (7e-05), and VC (1e-05).

For the future residents, the cumulative exposure to multiple airborne VOCs estimated an HI value of 3.5, which indicates a potential for adverse health effects. However, no individual COC exceeds an HQ value of 1. For the indoor occupational worker, there is not an indication of potential for adverse health effects based on a HI value of 0.6.

7.1.5 Uncertainty Analysis

There are inherent uncertainties in the risk evaluation that generally overestimate but can also underestimate the potential human health risks at Cooper Drum. The most common uncertainties related to toxicity information includes using: 1) dose-response information from animal studies to predict effects in humans; and 2) dose-response information for effects observed at elevated doses to predict adverse effects following exposure at low levels.

The oral RfDs and slope factors (SFs) were used to determine risks for dermal exposure. These toxicity values are generally based on an administered dose which is not directly comparable to absorbed doses through the skin, or for target organs other than the skin. Consequently, health risks or adverse effects identified through this exposure route are estimated and should be viewed with a moderate to high degree of uncertainty.

Other uncertainties include the 1) use of conservative and health-protective exposure factors; 2) the maximum or 95% UCL concentrations used for EPCs are likely to overestimate the overall chemical concentrations throughout Cooper Drum; and 3) assumption that contaminated groundwater in the shallow water-bearing zone underlying Cooper Drum would be used as an untreated source of potable drinking water.

7.2 Summary of Ecological Risk Assessment

A scoping-level ecological risk assessment was conducted to assess the potential for the existence of ecological receptors and pathways between those receptors and chemicals of potential ecological concern (COPECs) associated with Cooper Drum. This ecological scoping assessment was conducted in conformance with the DTSC guidance and was designed to assess the need for a follow-up screening-level ecological risk assessment. The results of those activities are discussed in detail in the Cooper Drum RI/FS Report (URS, 2002).

EPA's evaluation of potential risks to ecological receptors indicates that there is virtually no habitat present for birds or mammals at Cooper Drum. There is also no available habitat for vegetation due to the industrial nature of the site. Consequently, the potential for ecological receptors to be exposed to soil contaminants would be considered extremely minimal, and there is no need for any additional screening-level ecological risk assessment.

7.3 Risk Assessment Conclusion

The principal COCs for the groundwater pathway are 1,2,3-trichloropropane, TCE, and 1,2-DCA. Other COCs contributing to the overall groundwater risk include benzene, 1,1-DCA, cis-1,2-DCE, 1,2-dichloropropane, PCE, and vinyl chloride. Exposure to COCs detected in groundwater poses the greatest health risk to potential receptors. However, exposure to chemicals in groundwater presupposes that wells would be constructed to access the shallow water-bearing zone underneath Cooper Drum, and that the water would be used as an untreated water supply for domestic use.

The principal cancer risk driver for the soil pathway is benzo(a)pyrene, along with the PCB, Aroclor-1260, lead, benzo(b)fluoranthene, and dibenz(a,h)anthracene. The estimated total RME cancer risks for the future on-site resident and worker exposed to COCs in on-site soils are 3 in 10,000 (3.3e-04) and 7 in 100,000 (6.7e-05), respectively. Exposure to chemicals in soil presupposes the existing cover of asphalt concrete (95% of the site) would be removed and contact with soil would be possible.

Exposure to site COCs in indoor air, by on- or off-site workers and residents, represents the most likely exposure pathway evaluated in the HHRA. The estimated total RME cancer risks for the future on-site resident and on-site worker are 9.9e-04 and 2.3e-04, respectively. Exposure to chemicals in indoor air presupposes the asphalt concrete would be removed and buildings would be built on Cooper Drum. Currently, the only enclosed office area is on the west side of Cooper Drum away from the VOC hot spot.

The response action selected in this Record of Decision (ROD) is necessary to protect the public health or welfare or the environment from actual or threatened releases of hazardous substances, pollutants or contaminants from the Cooper Drum site which may present an imminent and substantial endangerment to public health or welfare.

Table 7-1a
Summary of Contaminants of Concern and Medium-Specific Exposure Point Concentrations (Soil 0-2 feet)

Scenario Timeframe: Current
Medium: Soil
Exposure Medium: Soil

Exposure Point	Contaminants of Concern	Concentration Detected (mg/kg)		Frequency of Detection	Exposure Point Concentration (mg/kg)	Statistical Measure
		Min	Max			
Soil (0 - 2 ft bgs) On-site Direct Contact	Benzo(a)anthracene	1.1	2.7	3/13	2.7	Max
	Benzo(a)pyrene	0.78	4.3	3/13	4.3	Max
	Benzo(b)fluoranthene	0.69	6.6	3/13	6.6	Max
	Benzo(k)fluoranthene	0.98	4.6	3/13	4.6	Max
	Dibenz(a,h)anthracene	0.15	1.1	3/13	1.1	Max
	Indeno(1,2,3-cd)pyrene	0.3	2.1	4/13	2.1	Max
	Aroclor-1254	0.0049	1.4	6/14	1.4	Max
	Aroclor-1260	0.0018	5.5	6/14	5.5	Max
	Lead	2.2	3,240	11/12	3,240	Max*
	Tetrachloroethene (PCE)	0.001	0.2	9/16	0.122	95% UCL

*	Maximum concentration used because data do not fit either normal or lognormal distribution.
Min	minimum detected concentration
Max	maximum detected concentration
95% UCL	95% Upper Confidence Limit
mg/kg	milligrams per kilogram
bgs	below ground surface

Table 7-1b
Summary of Contaminants of Concern and Medium-Specific Exposure Point Concentrations (Soil 0-12 feet)

Scenario Timeframe: Future
Medium: Soil
Exposure Medium: Soil

Exposure Point	Contaminants of Concern	Concentration Detected (mg/kg)		Frequency of Detection	Exposure Point Concentration (mg/kg)	Statistical Measure
		Min	Max			
Soil (0 - 12 ft. bgs) On-site Direct Contact	Benzo(a) anthracene	1.1	2.7	3/47	2.7	Max
	Benzo(a)pyrene	0.12	4.3	4/47	4.3	Max
	Benzo(b)fluoranthene	0.097	6.6	4/47	6.6	Max
	Benzo(k)fluoranthene	0.98	4.6	3/47	4.6	Max
	Chyrsene	0.12	4.7	4/47	4.7	Max
	Dibenz(a,h)anthracene	0.15	1.1	3/47	1.1	Max
	PCB Aroclor-1254	0.0049	2.1	12/47	2.1	Max
	PCB Aroclor-1260	0.0018	5.5	9/47	5.5	Max
	Lead	2.2	3,240	39/40	3,240	Max*
	Lead (without hot spot)	2.2	1,920	38/39	1,920	Max*
	Tetrachloroethene (PCE)	0.001	8.2	19/53	8.2	Max

Min minimum detected concentration
Max maximum detected concentration
bgs below ground surface
* Maximum concentration used because data do not fit either normal or lognormal distribution.

Table 7-1c
Summary of Contaminants of Concern and Medium-Specific Exposure Point Concentrations (Groundwater)

Scenario Timeframe: Future
Medium: Groundwater
Exposure Medium: Groundwater

Exposure Point	Contaminants of Concern	Concentration Detected (µg/L)		Frequency of Detection	Exposure Point Concentration (µg/L)	Statistical Measure
		Min	Max			
	Benzene	0.5	30	24/30	30	Max
	1,1-Dichloroethane (1,1-DCA)	0.5	340	26/30	340	Max
	1,1-Dichloroethene (1,1-DCE)	0.5	54	27/30	48	95% UCL
	1,2-Dichloroethane (1,2-DCA)	0.4	100	27/30	90.2	95% UCL
	cis-1,2-Dichloroethene (c-1,2-DCE)	0.5	1,200	28/30	1,150	95% UCL
	trans-1,2-Dichloroethene (t-1,2-DCE)	0.5	46	27/30	46	Max
	1,2-Dichloropropane (1,2-DCP)	0.3	50	24/30	43.9	95% UCL
	Tetrachloroethene (PCE)	0.5	57	15/30	52.9	95% UCL
	Trichloroethene (TCE)	0.5	800	28/30	755	95% UCL
	1,2,3-Trichloropropane (TCP)	1	50	20/23	45	95% UCL
	Vinyl chloride	0.5	15	25/30	13.2	95% UCL

Min — minimum detected concentration
µg/L — microgram per liter
Max — maximum detected concentration
95% UCL — 95% Upper Confidence Limit

Table 7-1d
Summary of Contaminants of Concern and Medium-Specific Exposure Point Concentrations (Indoor Air)

Scenario Timeframe: Future
Media: Soil, groundwater, and soil gas
Exposure Medium: Indoor air

Exposure Point	Contaminants of Concern	Concentration Detected* (µg/m³) Min	Concentration Detected* (µg/m³) Max	Frequency of Detection	Exposure Point Concentration** (µg/m³)	Statistical Measure**
Indoor Air	Benzene	0.0023	0.0203	N/A	0.359	N/A
	1,4-Dichlorobenzene***	0.000289	0.1	N/A	0.565	N/A
	1,1-Dichloroethane (1,1-DCA)	0.338	2.90	N/A	4.93	N/A
	cis-1,2-Dichlorethene (c-1,2-DCE)	0.573	17	N/A	23.5	N/A
	1,2-Dichloropropane (1,2-DCP)	0.0154	0.232	N/A	0.316	N/A
	Tetrachloroethene (PCE)	0.155	119	N/A	120	N/A
	Trichloroethene (TCE)	0.966	4.57	N/A	6.49	N/A
	1,2,3-Trichloropropane (TCP) ****	0.253	0.468	N/A	0.697	N/A
	Vinyl chloride	0.0847	1.51	N/A	1.59	N/A

* Concentrations were developed from soil and groundwater concentrations using the Johnson and Ettinger Model. (USEPA 2000).
** Total concentration from all media.
*** A surrogate, 1,2-Dichlorobenzene was used to estimate indoor air concentrations.
**** A surrogate, 1,1-Dichloroethene was used to estimate indoor air concentrations.
Min minimum detected concentration
Max maximum detected concentration
N/A Not available or applicable
µg/m³ microgram per cubic meter

Table 7-2
Cancer Toxicity Data Summary
(Page 1 of 2)

Pathway: **Ingestion, Dermal**

Contaminants of Concern	Oral/Dermal Cancer Slope Factor $(mg/kg\text{-}day)^{-1}$	Weight of Evidence Classification	Source	Date (MM/DD/YYYY)
Benzene	0.1	A	Ca	05/01/2002
1,1-Dichloroethane (1,1-DCA)	0.0057	C	Ca	05/01/2002
1,2-Dichloroethane (1,2-DCA)	0.091	B2	i	01/01/1991
1,2-Dichloropropane (1,2-DCP)	0.068	C	h	10/01/1999
Tetrachloroethene (PCE)	0.052	B2	n	10/01/1999
Trichloroethene (TCE)	0.0153	B2	Ca	05/01/2002
1,2,3-Trichloropropane (TCP)	7	C	h	10/01/1999
Vinyl chloride	1.55	A	i	08/07/200
Benzo(a) anthracene	1.2	B2	Ca	05/01/2002
Benzo(a)pyrene	12	B2	Ca	05/01/2002
Benzo(b) fluoranthene	1.2	B2	Ca	05/01/2002
Benzo(k)fluoranthene	1.2	B2	Ca	05/01/2002
Chrysene	0.12	B2	Ca	05/01/2002
Dibenz(a,h)anthracene	7.3	B2	Ca	05/01/2002
Indeno (1,2,3-cd) pyrene	1.2	B2	Ca	05/01/2002
Aroclor-1254	5	B2	Ca	05/01/2002
Aroclor-1260	5	B2	Ca	05/01/2002

Ca Cal/EPA Cancer Potency Factor (CPF) value, Office of Environmental Health Hazard Assessment (OEHHA) (Cal/EPA)
h Health Effect Assessment Summary Tables (HEAST) - from USEPA Region 9 PRG Table (USEPA 2000)
i Integrated Risk Information System (IRIS) (USEPA 2001)
r route-to-route extrapolation - from USEPA Region 9 PRG Table (USEPA 2000)
n National Cancer for Environmental Assessment (NCEA) - from USEPA Region 9 PRG Table (USEPA 2000)
N/A Not available or applicable
A Human carcinogen
B2 Probably human carcinogen - Indicates sufficient evidence in animals and inadequate or no evidence in humans
C Possible human carcinogen

Table 7-2
Cancer Toxicity Data Summary
(Page 2 of 2)

Pathway: Inhalation

Contaminants of Concern	Unit Risk ($\mu g/m^3$)	Inhalation Cancer Slope Factor $(mg/kg\text{-}day)^{-1}$	Weight of Evidence/ Cancer Guideline Description	Source	Date (MM/DD/YYYY)
Benzene	2.9e-05	0.1	A	Ca	10/01/1999
1,1-Dichloroethane (1,1-DCA)	1.6e-06	0.0057	C	Ca	05/01/2002
1,2-Dichloroethane (1,2-DCA)	2.2e-05	0.091	B2	i	01/01/1991
1,2-Dichloropropane (1,2-DCP)	1.8e-05	0.068	--	r	10/01/1999
Tetrachloroethene (PCE)	5.9e-06	0.0210	B2	Ca	05/01/2002
Trichloroethene (TCE)	2.0e-06	0.01	B2	Ca	05/01/2002
1,2,3-Trichloropropane (TCP)	N/A	7	C	r	10/01/1999
Vinyl chloride	7.8e-05	0.27	A	Ca	05/01/2002
Benzo(a)anthracene	1.1e-04	0.39	B2	Ca	05/01/2002
Benzo(a)pyrene	1.1e-03	3.9	B2	Ca	05/01/2002
Benzo(b) fluoranthene	1.1e-04	0.39	B2	Ca	05/01/2002
Benzo(k)fluoranthene	1.1e-04	0.39	B2	Ca	05/01/2002
Chrysene	1.1e-05	0.039	B2	Ca	05/01/2002
Dibenz(a,h)anthracene	1.2e-03	4.1	B2	Ca	05/01/2002
Indeno (1,2,3-cd) pyrene	1.1e-04	0.39	B2	Ca	05/01/2002
Aroclor-1254	5.7e-04	2.00	B2	Ca	05/01/2002
Aroclor-1260	5.7e-04	2.00	B2	Ca	05/01/2002

Ca Cal/EPA Cancer Potency Factor (CPF) value, Office of Environmental Health Hazard Assessment (OEHHA) (Cal/EPA)
h Health Effect Assessment Summary Tables (HEAST) - from USEPA Region 9 PRG Table (USEPA 2000)
i Integrated Risk Information System (IRIS) (USEPA 2001)
r route-to-route extrapolation - from USEPA Region 9 PRG Table (USEPA 2000)
n National Cancer for Environmental Assessment (NCEA) - from USEPA Region 9 PRG Table (USEPA 2000)
N/A Not available or applicable
A Human carcinogen
B2 Probably human carcinogen - Indicates sufficient evidence in animals and inadequate or no evidence in humans
C Possible human carcinogen

Table 7-3 Non-Cancer Toxicity Date Summary (Page 1 of 2)					
Pathway: **Ingestion, Dermal**					
Contaminants of Concern	**Chronic/ Subchronic**	**Oral/Dermal RfD Value (mg/kg-day)**	**Primary Target Organ**	**Source**	**Dates of RfD: Target Organ (MM/DD/YYYY)**
Benzene	Chronic	0.1	blood	h	10/01/1999
1,1-Dichloroethane (1,1-DCA)	Chronic	0.1	kidney	h	10/01/1999
1,2-Dichloroethane (1,2-DCA)	Chronic	0.0014	kidney	n	10/01/1999
1,1-Dichloroethene (1,1-DCE)	Chronic	0.057	liver	i	08/13/2002
1,2-Dichloropropane (1,2-DCP)	Chronic	0.0011	nasal mucous	r	10/01/1999
cis-1,2-Dichloroethene (cis-1,2-DCE)	Chronic	0.001	blood	h	10/01/1999
trans-1,2-Dichloroethene (trans-1,2-DCE)	Chronic	0.001	blood	i	01/01/1989
Tetrachloroethene (PCE)	Chronic	0.11	liver	i	03/01/1998
Trichloroethene (TCE)	Chronic	0.006	liver	x	10/01/1999
1,2,3-Trichloropropane (TCP)	Chronic	0.005	body mass	i	08/01/1990
Vinyl chloride	Chronic	0.029	liver	i	08/07/2000
Aroclor-1254	Chronic	2.0e-05	immune system	i	11/01/1996

N/A Not available; chemical is non-carcinogenic or toxicity values not established.
h Health Effect Assessment Summary Tables (HEAST) - from USEPA Region 9 PRG Table
i Integrated Risk Information System (IRIS) - USEPA 2001
r route-to-route extrapolation - from USEPA Region 9 PRG Table
n National Center for Environmental Assessment (NCEA) - from USEPA Region 9 PRG Table
x Value currently under review - from USEPA Region 9 PRG Table

Table 7-3
Non-Cancer Toxicity Date Summary
(Page 2 of 2)

Pathway: Inhalation

Contaminants of Concern	Chronic/ Subchronic	Inhalation RfD (mg/kg-day)	Primary Target Organ	Source	Dates of RfD: Target Organ (MM/DD/YYYY)
Benzene	Chronic	0.0017	blood	r	10/01/1999
1,1-Dichloroethane (1,1-DCA)	Chronic	0.14	kidney	h	10/01/1999
1,2-Dichloroethane (1,2-DCA)	Chronic	0.0014	lungs	n	10/01/1999
1,1-Dichloroethene (1,1-DCE)	Chronic	0.057	liver	i	08/13/2002
1,2-Dichloropropane (1,2-DCP)	Chronic	0.0011	nasal mucous, blood	i	12/01/1991
cis-1,2-Dichloroethene (cis-1,2-DCE)	Chronic	0.001	blood	r	10/01/1999
trans-1,2-Dichloroethene (trans-1,2-DCE)	Chronic	0.002	immune system, blood	r	10/01/1999
Tetrachloroethene (PCE)	Chronic	0.11	liver	n	10/01/1999
Trichloroethene (TCE)	Chronic	0.006		r	10/01/1999
1,2,3-Trichloropropane (TCP)	Chronic	0.005	body mass	r	10/01/1999
Vinyl chloride	Chronic	0.029	liver	i	08/07/2000
Aroclor-1254	Chronic	2.00e-05	immune system	r	10/01/1999

N/A Not available; chemical is non-carcinogenic or toxicity values not established.
h Health Effect Assessment Summary Tables (HEAST) - from USEPA Region 9 PRG Table
i Integrated Risk Information System (IRIS) - USEPA 2001
r route-to-route extrapolation - from USEPA Region 9 PRG Table
n National Center for Environmental Assessment (NCEA) - from USEPA Region 9 PRG Table
x Value currently under review - from USEPA Region 9 PRG Table

Table 7-4a
Risk Characterization Summary - Carcinogens (Worker)
(Page 1 of 2)

Scenario Timeframe: Current
Receptor Population: On-site Worker
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Contaminants of Concern	Carcinogenic Risk Ingestion	Carcinogenic Risk Inhalation	Carcinogenic Risk Dermal	Carcinogenic Risk Total
Soil	Soil	On-site-Direct Contact	Benzo(a)anthracene	5.7e-07	1.3e-12	9.7e-07	1.5e-06
		On-site-Direct Contact	Benzo(a) pyrene	9.0e-06	2.1e-11	1.5e-05	2.4e-05
		On-site-Direct Contact	Benzo(b) fluoranthene	1.4e-06	3.3e-12	2.4e-06	3.8e-06
		On-site-Direct Contact	Benzo(k) fluoranthene	9.7e-07	2.3e-12	1.7e-06	2.7e-06
		On-site-Direct Contact	Dibenz(a,h) anthracene	1.4e-06	5.7e-12	2.4e-06	3.8e-06
		On-site-Direct Contact	Indeno(1,2,3-cd)pyrene	4.4e-07	1.2e-12	7.6e-07	1.2e-06
		On-site-Direct Contact	Aroclor-1254	1.2e-06	3.6e-12	2.4e-06	3.6e-06
		On-site-Direct Contact	Aroclor-1260	4.8e-06	1.4e-11	9.5e-06	1.4e-05
		On-site-Direct Contact	Tetrachloroethene (PCE)	1.1e-09	5.6e-06	1.5e-09	5.6e-06
						Soil Risk Total =	6.7e-05

Table 7-4a
Risk Characterization Summary - Carcinogens (Worker)
(Page 2 of 2)

Scenario Timeframe: Current
Receptor Population: On-site Worker
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Contaminants of Concern	Carcinogenic Risk			
				Ingestion	Inhalation	Dermal	Total
Soil, Ground water, Soil Gas	Indoor Vapors (VOCs)	Inhalation of Indoor Air	Benzene	N/A	1.0e-06	N/A	1.0e-06
		Inhalation of Indoor Air	1,4-Dichlorobenzene	N/A	6.4e-07	N/A	6.4e-07
		Inhalation of Indoor Air	Tetrachloroethene (PCE)	N/A	7.2e-05	N/A	7.2e-05
		Inhalation of Indoor Air	Trichloroethene (TCE)	N/A	1.8e-06	N/A	1.8e-06
		Inhalation of Indoor Air	1,2,3-Trichloropropane (TCP)	N/A	1.4e-04	N/A	1.4e-04
		Inhalation of Indoor Air	Vinyl Chloride	N/A	1.2e-05	N/A	1.2e-05
						Air Risk Total =	2.3e-04
						Total Risk =	2.9e-04

N/A route of exposure is not applicable to this medium
VOCs volatile organic compounds

Table 7-4b
Risk Characterization Summary - Carcinogens (Resident)
(Page 1 of 3)

Scenario Timeframe: Future
Receptor Population: Resident
Receptor Age: Adult/child

Medium	Exposure Medium	Exposure Point	Contaminants of Concern	Carcinogenic Risk			
				Ingestion	Inhalation	Dermal	Exposure Routes Total
Soil	Soil	Soil On-site Direct Contact	Benzo(a) anthracene	5.1e-06	2.9e-12	2.1e-06	7.1e-06
		Soil On-site Direct Contact	Benzo(a) pyrene	8.1e-05	4.6e-11	3.3e-05	1.1e-04
		Soil On-site Direct Contact	Benzo(b) fluoranthene	1.2e-05	7.0e-12	5.1e-06	1.7e-05
		Soil On-site Direct Contact	Benzo(k) fluoranthene	8.6e-06	4.9e-12	3.6e-06	1.2e-05
		Soil On-site Direct Contact	Chrysene	8.8e-07	1.5e-08	3.6e-07	1.3e-06
		Soil On-site Direct Contact	Dibenz(a,h) anthracene	1.3e-05	1.2e-11	5.2e-06	1.8e-05
		Soil On-site Direct Contact	Aroclor-1254	1.6e-05	7.6e-12	7.8e-06	2.4e-05
		Soil On-site Direct Contact	Aroclor-1260	4.3e-05	3.0e-11	2.0e-05	6.3e-05
		Soil On-site Direct Contact	Dieldrin	1.0e-06	1.4e-12	3.2e-07	1.3e-06
		Soil On-site Direct Contact	Tetrachloroethene (PCE)	6.7e-07	1.2e-05	2.1e-07	1.3e-05
						Soil Risk Total =	3.3e-04

Table 7-4b
Risk Characterization Summary - Carcinogens (Resident)
(Page 2 of 3)

Scenario Timeframe: Future
Receptor Population: Resident
Receptor Age: Adult/child

Medium	Exposure Medium	Exposure Point	Contaminants of Concern	Carcinogenic Risk			
				Ingestion	Inhalation	Dermal	Exposure Routes Total
Ground water	Groundwater	Gaspur Aquifer - Tap Water	Benzene	4.5e-05	2.2e-04	2.4e-06	2.7e-04
		Gaspur Aquifer - Tap Water	1,1-Dichloroethane (1,1-DCA)	2.9e-05	1.5e-04	6.7e-07	1.8e-04
		Gaspur Aquifer - Tap Water	1,2,3-trichloropropane	4.7e-03	2.4e-02	6.1e-05	2.9e-02
		Gaspur Aquifer - Tap Water	1,2-Dichloroethane (1,2-DCA)	1.2e-04	6.1e-04	1.7e-06	7.3e-04
		Gaspur Aquifer - Tap Water	1,2-Dichloropropane (1,2-DCP)	4.5e-05	2.2e-04	1.2e-06	2.7e-04
		Gaspur Aquifer - Tap Water	Tetrachloroethene (PCE)	4.1e-05	8.3e-05	5.1e-06	1.3e-04
		Gaspur Aquifer - Tap Water	Trichloroethene (TCE)	1.7e-04	5.6e-04	7.2e-06	7.4e-04
		Gaspur Aquifer - Tap Water	Vinyl chloride	3.1e-04	2.7e-04	5.8e-06	5.9e-04
						Groundwater Risk Total =	3.2e-02

Table 7-4b
Risk Characterization Summary - Carcinogens (Resident)
(Page 3 of 3)

Scenario Timeframe: Future
Receptor Population: Resident
Receptor Age: Adult/child

Medium	Exposure Medium	Exposure Point	Contaminants of Concern	Carcinogenic Risk			
				Ingestion	Inhalation	Dermal	Exposure Routes Total
Soil, Ground water, soil gas	Indoor Air	Inhalation of Indoor Air	Benzene	N/A	4.4e-06	N/A	4.4e-06
		Inhalation of Indoor Air	1,4-Dichlorobenzene	N/A	2.8e-06	N/A	2.8e-06
		Inhalation of Indoor Air	1,1-Dichloroethane (1,1-DCA)	N/A	3.5e-06	N/A	3.5e-06
		Inhalation of Indoor Air	1,2-Dichloropropane (1,2-DCP)	N/A	2.7e-06	N/A	2.7e-06
		Inhalation of Indoor Air	Tetrachloroethene (PCE)	N/A	3.1e-04	N/A	3.1e-04
		Inhalation of Indoor Air	Trichloroethene (TCE)	N/A	8.0e-06	N/A	8.0e-06
		Inhalation of Indoor Air	1,2,3-Trichloropropane	N/A	6.1e-04	N/A	6.1e-04
		Inhalation of Indoor Air	Vinyl Chloride	N/A	5.3e-05	N/A	5.3e-05
						Indoor Air Risk Total =	9.9e-04
						Total Risk (soil, groundwater, indoor air) =	3.4e-02

N/A Route of exposure is not applicable to this medium
NC Non-carcinogenic (USEPA Class D or E)

Table 7-5a
Risk Characterization Summary - Non-Carcinogens (Worker)
(Page 1 of 1)

Scenario Timeframe: Current
Receptor Population: Worker
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Contaminants of Concern	Primary Target Organ	Non-Carcinogenic Hazard Quotient (HQ)			
					Ingestion	Inhalation	Dermal	Exposure Routes Total
Soil	Soil	Soil On-Site Direct Contact	Aroclor-1254	immune system	3.4e-02	2.5e-07	6.8e-02	1.0e-01
		Soil On-Site Direct Contact	Tetrachloroethene (PCE)	liver (hepa toxicity)	6.0e-06	6.8e-03	7.9e-06	6.8e-03
							Soil HI Total =	0.3
Soil, Ground water, soil gas	Indoor Air	Inhalation of Indoor Air	Benzene	blood	N/A	0.02	N/A	0.02
		Inhalation of Indoor Air	1,4-Dichlorobenzene	liver	N/A	2.0e-04	N/A	2.0e-04
		Inhalation of Indoor Air	1,1-Dichloroethane (1,1-DCA)	kidney	N/A	2.8e-03	N/A	2.8e-03
		Inhalation of Indoor Air	cis-1,2-Dichloroethene (c-1,2-DCE)	blood	N/A	0.2	N/A	0.2
		Inhalation of Indoor Air	1,2-Dichloropropane (1,2-DCP)	nasal mucous	N/A	0.02	N/A	0.02
		Inhalation of Indoor Air	Tetrachloroethene (PCE)	liver	N/A	0.1	N/A	0.1
		Inhalation of Indoor Air	Trichloroethene (TCE)	liver	N/A	0.1	N/A	0.1
		Inhalation of Indoor Air	1,2,3-Trichloropropane	Body mass	N/A	0.01	N/A	0.01
		Inhalation of Indoor Air	Vinyl Chloride	liver	N/A	4.4e-03	N/A	4.4e-03
							Indoor Air HI Total =	0.6
							Total HI (soil, indoor air) =	0.9

N/A Route of exposure is not applicable to this medium

Table 7-5b
Risk Characterization Summary - Non-Carcinogens (Resident)
(Page 1 of 3)

Scenario Timeframe: Future
Receptor Population: Resident
Receptor Age: Child

Medium	Exposure Medium	Exposure Point	Contaminants of Concern	Primary Target Organ	Non-Carcinogenic Hazard Quotient (HQ)			
					Ingestion	Inhalation	Dermal	Exposure Routes Total
Soil	Soil and airborne particulate matter and vapors (VOCs)	Soil On-site Direct Contact, Inhalation	Aroclor-1254	immune system	1.3e+00	8.1e-07	5.6e-01	1.9e+00
		Soil On-site Direct Contact, Inhalation	Dieldrin	liver	1.1e-02	7.2e-09	2.9e-03	1.3e-02
		Soil On-site Direct Contact, Inhalation	Lead	CNS	99th percentile blood lead levels = 36.0 µg/dL (adult) and 127.3 µg/dL (child)			
		Soil On-site Direct Contact, Inhalation	Lead (without hot sport)	CNS	99th percentile blood lead levels = 22.7 µg/dL (adult) and 77.3 µg/dL (child)			
		Soil On-site Direct Contact, Inhalation	Tetrachloro ethene (PCE)	liver	1.1e-02	2.2e-02	2.9e-03	3.5e-02
							Soil HI Total =	3.0

Table 7-5b
Risk Characterization Summary - Non-Carcinogens (Resident)
(Page 2 of 3)

Scenario Timeframe: Future
Receptor Population: Resident
Receptor Age: Child

Medium	Exposure Medium	Exposure Point	Contaminants of Concern	Primary Target Organ	Non-Carcinogenic Hazard Quotient (HQ)			
					Ingestion	Inhalation	Dermal	Exposure Routes Total
Ground Water	Ground Water	Gaspur Aquifer - Tap Water	Benzene	blood	6.4e-01	5.6e+00	2.9e-02	6.3e+00
		Gaspur Aquifer - Tap Water	1,1-Dichloro-ethane (1,1-DCA)	kidney	2.2e-01	7.8e-01	4.2e-03	1.0e+00
		Gaspur Aquifer - Tap Water	1,1-Dichloro-ethene (1,1-DCE)	liver	6.1e-02	2.7e-01	2.1e-03	3.3e-01
		Gaspur Aquifer - Tap Water	1,2,3-trichloro-propane (TCP)	blood	4.8e-01	2.9e+00	5.1e-03	3.4e+00
		Gaspur Aquifer - Tap Water	1,2-Dichloro-ethane (1,2-DCA)	lungs	1.9e-01	2.1e+01	2.2e-03	2.1e+01
		Gaspur Aquifer - Tap Water	1,2-Dichloro-propane (1,2-DCP)	olfactory (nasal) epithelium, blood	2.6e+00	1.3e+01	5.4e-02	1.6e+01
		Gaspur Aquifer - Tap Water	cis-1,2-Dichloro-ethene (c-1,2-DCE)	decreased hemato-crit and hemo-globin	7.4e+00	3.7e+01	1.6e-01	4.5e+01
		Gaspur Aquifer - Tap Water	Tetrachloro-ethene (PCE)	liver	3.4e-01	1.5e-01	3.5e-02	5.3e-01
		Gaspur Aquifer - Tap Water	trans-1,2-Dichloroethene (t-1,2-DCE)	immune system, spleen, blood	1.5e-01	7.3e-01	3.1e-03	8.8e-01
		Gaspur Aquifer - Tap Water	Trichloroethene (TCE)	liver	8.0e+00	4.0e+01	2.7e-01	4.8e+01
		Gaspur Aquifer - Tap Water	Vinyl chloride	liver	2.8e-01	1.5e-01	4.4e-03	4.3e-01
							Groundwater HI Total =	186

Table 7-5b
Risk Characterization Summary - Non-Carcinogens (Resident)
(Page 3 of 3)

Scenario Timeframe: Future
Receptor Population: Resident
Receptor Age: Child

Medium	Exposure Medium	Exposure Point	Contaminants of Concern	Primary Target Organ	Non-Carcinogenic Hazard Quotient (HQ)			
					Ingestion	Inhalation	Dermal	Exposure Routes Total
Soil and Ground water	Indoor Air	Inhalation of Indoor Air	Benzene	hemato-poietic effects	N/A	1.0e-01	N/A	1.0e-01
		Inhalation of Indoor Air	1,4-Dichlorobenzene	liver	N/A	1.2e-03	N/A	1.2e-03
		Inhalation of Indoor Air	1,1-Dichloroethane (1,1-DCA)	kidney	N/A	1.7e-02	N/A	1.7e-02
		Inhalation of Indoor Air	1,2-Dichloropropane (1,2-DCP)	olfactory epithelium, blood	N/A	1.4e-01	N/A	1.4e-01
		Inhalation of Indoor Air	Tetrachloroethene (PCE)	liver	N/A	5.3e-01	N/A	5.3e-01
		Inhalation of Indoor Air	Trichloroethene (TCE)	liver	N/A	5.3e-01	N/A	5.3e-01
		Inhalation of Indoor Air	1,2,3-Trichloropropane	blood	N/A	6.8e-02	N/A	6.8e-02
		Inhalation of Indoor Air	Vinyl chloride	liver	N/A	2.7e-02	N/A	2.7e-02
Air HI Total =								3.5
Total HI (soil, groundwater, indoor air) =								192.5

N/A route of exposure is not applicable to this medium
CNS central nervous system

8.0 Remedial Action Objectives

The remedial action objectives (RAOs) for Cooper Drum are to protect human health and the environment from exposure to contaminated soil, groundwater, and indoor air, and to restore the groundwater to a potential beneficial use as a drinking water source. The selected remedy meets these RAOs through treatment of soil and groundwater contaminated with VOCs and, where feasible, the removal of soil contaminated with non-VOCs. The RAOs also serve to facilitate the five-year review determination of protectiveness of human health and the environment.

The RAOs for Cooper Drum are listed below:

Groundwater

- Restore the groundwater through VOC treatment to drinking water standards (MCLs) for beneficial use;

Soil

- Remediate soil COCs (VOCs) to prevent contaminants from migrating into groundwater at levels that would exceed drinking water standards; and

- Where feasible, remediate non-VOC contaminated soil above health-based action levels that are protective of ongoing and potential future site uses.

Indoor Air

- Remediate COCs (VOCs) in soil and groundwater to health-based action levels to eliminate potential exposures to indoor air contaminants created by site contamination.

The RAOs were formed based on the following:

- Reasonable anticipated land use scenarios used in the human health risk assessment that include continuation of heavy industrial land use and the possibility of future development for on-site residential land use;

- The soil contaminants pose a continuing contaminant threat to the aquifer (identified as a potential drinking water source) underlying Cooper Drum; and

- The human health risk assessment identified the COCs driving the need for remedial action (risk drivers) and need for remedial action protective of human health.

9.0 Description of Alternatives

From the screening of technologies, EPA evaluated and assembled a range of alternatives including:

Soil Alternatives

- Alternative 1 - No Action
- Alternative 2 - Dual Phase Extraction/GAC*/Institutional Control
- Alternative 3 - Dual Phase Extraction/GAC/Institutional Control/Excavation

* GAC - Granular Activated Carbon

Groundwater Alternatives

- Alternative 1 - No Action
- Alternative 2 - Extraction/GAC
- Alternative 3 - Extraction/GAC/In Situ Chemical Oxidation*
- Alternative 4 - Extraction/GAC/In Situ Chemical Treatment - Reductive Dechlorination and Oxidation
- Alternative 5 - Extraction/GAC/In Situ Chemical Treatment - Reductive Dechlorination*
- Alternative 6 - In-Well Air Stripping with Groundwater Circulation Wells

* Groundwater Alternatives 3, 4, and 5 share the common components of extraction and ex situ physical treatment for VOCs. With regards to in situ treatment, groundwater Alternative 4 (chemical oxidation and reductive dechlorination) is a combination of Alternative 3 (chemical oxidation) and 5 (reductive dechlorination). Therefore, groundwater Alternatives 3 and 5 have been deleted from the ROD as separate alternatives.

9.1 Description of Soil Alternatives/Remedy Components

9.1.1 Soil Alternative 1 - No Action

In accordance with the NCP, a no action alternative must be evaluated to serve as a basis for comparison with other remedial alternatives. Under this remedial action, no action is undertaken toward cleanup or reducing the risk to human health. There is no capital cost or operation and maintenance cost associated with this alternative. Because this alternative is not protective of human health and the environment and does not comply with applicable or relevant and appropriate requirements (ARARs), this alternative is not further evaluated.

9.1.2 Soil Alternative 2 - Dual Phase Extraction/GAC/Institutional Controls

Treatment Components

This alternative applies a physical treatment technology combined with institutional controls. The physical treatment entails using dual phase extraction (DPE) to treat the VOCs in soil. DPE is an enhancement of the conventional soil vapor extraction (SVE) technology; it is a process in which contaminated soil vapors and groundwater are extracted simultaneously. SVE has been established as an EPA presumptive remedy for cleanup of VOCs in soil. The alternative includes three wells to extract both groundwater and soil gas and five vapor monitoring wells. Soil vapors and groundwater contaminants would be extracted and treated with granular activated carbon (GAC) in vessels. Additives, such as potassium permanganate, would be used to treat any vinyl chloride contamination. There are two discharge options for the treated groundwater, discharge to publicly owned treatment works (POTW) and reinjection to the aquifer. The treated soil gas would be discharged into the atmosphere. The estimated soil volume to be treated under the HWA using DPE is approximately 77,000 cubic yards (this assumes treatment down to a depth of 50 feet bgs.)

Institutional Control Components

Institutional controls will be placed on Cooper Drum to restrict use. These controls limit future use of Cooper Drum by eliminating exposure to non-VOC soil contaminants and consist of a restrictive covenant which will: 1) place limitations on activities that might expose the subsurface; 2) prevent future use including residential, hospital, day care center and school uses; and 3) notify property users and the public of these controls. This restrictive covenant will be binding on subsequent property owners and will remain in place as long as soil contaminated with non-VOCs remains on the property and poses a health risk.

Monitoring Components

The total duration of the DPE remedial action is assumed to be five years. Operation of the DPE system is estimated to continue for approximately two years. One baseline sampling event and three post-remedial action compliance sampling events of vapor monitoring and groundwater extraction wells are planned.

Operation and Maintenance (O&M) Components

O&M activities for VOC treatment using DPE are related to upkeep of the extraction systems and the liquid and vapor GAC treatment facilities, including controls and communications systems, mechanical components (e.g., blowers, submersible pumps, flow meters, valves, connections), disposal of spent GAC and recharging of the GAC vessels, pipeline maintenance, extraction and vapor monitoring well maintenace, grounds upkeep, and reporting of spills, uncontrolled emissions, or other anomalous occurrences.

O&M activities related to institutional controls consist of administrative oversight of site activities and periodic inspections.

Expected Outcomes

Dual phase extraction is expected to remove existing VOC contamination in soil to levels that prevent impact to the aquifer below ground and to the indoor air quality above ground. Since non-VOC soil contamination will be left on site under Alternative 2, institutional controls will be implemented on Cooper Drum to restrict future land use, including residential, hospital, day care center and school uses.

9.1.3 Soil Alternative 3 Dual Phase Extraction/GAC/ Institutional Controls/Excavation

Treatment Components

Alternative 3 is similar to Alternative 2 in that it applies physical treatment combined with institutional controls, but it also includes the excavation and off-site disposal of soil contaminated with non-VOCs. DPE with GAC treatment, as described in Alternative 2, would be used to remediate an estimated 77,000 cubic yards of VOC-contaminated soil. Excavation would remove an estimated 2,700 tons of contaminated soil and effectively remove any potential health risk resulting from exposure to non-VOCs. Soil would be transported off site to an approved landfill.

Institutional Control Components

Institutional controls would be used in areas where soil excavation is not feasible. Emission control measures would be taken during soil excavation to eliminate potential problems associated with dust and exposure to subsurface contaminants.

Monitoring Components

Vapor monitoring requirements would be similar to Alternative 2. Confirmation soil samples would be obtained in excavated soil areas.

Operation and Maintenance (O&M) Components

O&M activities for VOC treatment using DPE and institutional controls are the same as for Alternative 2.

Expected Outcomes

Dual phase extraction is expected to remove existing VOC contamination in soil to levels that prevent impact to the aquifer below ground and to the indoor air quality above ground. No land use restrictions are expected if all soil contaminated with non-VOCs is excavated and removed off site. Restrictions on future land use, including residential, hospital, day care center and school uses, will be implemented for Cooper Drum with the understanding that excavation of all non-VOC contaminated soil is deemed infeasible (e.g., under existing structures). Land use restrictions could be lifted if the contaminated soil beneath structures is removed or treated prior to future land development.

9.2 Description of Groundwater Alternatives/Remedy Components

9.2.1 Groundwater Alternative 1 - No Action

In accordance with the NCP, a no action alternative must be evaluated to serve as a basis for comparison with other remedial alternatives. Under this remedial action, no action is undertaken toward cleanup or reducing the risk to human health. There is no capital cost or operation and maintenance cost associated with this alternative. Because this alternative is not protective of human health and the environment and does not comply with ARARs, this alternative is not further evaluated.

9.2.2 Groundwater Alternative 2 - Extraction/GAC

Treatment Components

Alternative 2 applies physical treatment technology using vertical wells to extract VOC-contaminated groundwater and liquid-phase GAC vessels to remove the VOCs. The alternative would contain the groundwater contamination beneath Cooper Drum. However, groundwater extraction may result in further commingling of on-site plumes with upgradient plumes originating off site. Three vertical extraction wells would be used to extract groundwater at a rate of up to 33 gallons per minute (gpm) per well. The rate of extraction would have to be closely monitored and adjusted to minimize the potential for plume commingling.

The extracted water would be pumped through two vessels containing liquid-phase activated carbon. The treatment plant capacity would be 100 gpm. To treat vinyl chloride, potassium permanganate would also be added. In this way, all COCs in groundwater would be treated down to drinking water standards.

Containment Components

Groundwater extraction would contain and control further migration of the plume. The treated water could be reinjected into the groundwater aquifer or discharged to a POTW. If reinjection is selected, three new injection wells would be installed upgradient of the HWA. Reinjection of treated groundwater into the plume must meet state policies and waste discharge conditions. The benefits of reinjection include reducing the possible commingling with off-site plumes, diluting the groundwater contaminants, and flushing the contaminants toward the extraction wells. Discharge to a POTW located off site would have to comply with waste discharge requirements and payment of connection and usage fees.

Monitoring Components

Depending on various factors, the time required to capture the VOC plume was estimated to be between 13 and 20 years. For cost estimation purposes, the duration of remedial action was set to 20 years. After the first year of operation, the monitoring frequency for VOCs would be as follows: bi-weekly at the treatment plant, monthly at the extraction wells, and semi-annually at the monitoring wells. Annual compliance monitoring of all wells would continue for at least three years after completion of remedial action. This monitoring scheme was the basis of the cost analysis, however, site conditions may require changes to monitoring frequencies.

Required O&M

O&M activities for VOC treatment are related to upkeep of the extraction systems and the liquid GAC treatment facilities, including controls and communications systems, mechanical components (e.g., external and submersible pumps, flow meters, valves, connections), disposal of spent GAC and recharging of the GAC vessels, pipeline maintenance, extraction and injection well maintenace (may include periodic cleaning/acid washing), monitoring well maintenace, grounds upkeep, and reporting of spills or other anomalous occurrences.

Expected Outcomes

The contaminated groundwater under Cooper Drum is semi-confined in the upper aquifer. Implementation of groundwater Alternative 2 would remove VOC contamination above drinking water standards in the shallow aquifer and would protect the existing beneficial use of the currently uncontaminated deeper aquifers.

9.2.3 Groundwater Alternative 4 - Extraction/GAC/In Situ Chemical Treatment-Reductive Dechlorination and Oxidation

Treatment Components

Alternative 4 combines the use of ex situ physical and in situ chemical treatment technologies. Similar to Alternative 2, physical treatment would entail extracting groundwater contaminated with VOCs and treating it with GAC, so as to clean up and contain the groundwater contamination underneath Cooper Drum. Chemical treatment of VOCs in groundwater would be enhanced with in situ chemical treatment using either reductive dechlorination or chemical oxidation.

Use of enhanced reductive dechlorination treatment could expedite natural attenuation without the need for chemical oxidants. Because of the reliance on natural attenuation processes, the time required for complete cleanup is uncertain. If a chemical oxidant is used, oxidation would occur fairly quickly (i.e., within days).

Pilot-scale treatability studies would be required to determine the effectiveness of in situ reductive dechlorination and chemical oxidation. The results of the treatability tests would be used to determine which in situ technology (i.e., reductive dechlorination or oxidation) is most effective under site conditions. For costing purposes, it was assumed that both technologies would be used to enhance the treatment of groundwater contamination.

Compared to Alternative 2, using these two in situ treatment options individually or in combination would most likely reduce the time required for meeting remedial goals. It is expected that in situ oxidation would significantly reduce the concentrations of several prominent VOCs (i.e., PCE, TCE, DCE, and vinyl chloride) and reduce the time required to clean up the groundwater, as compared to Alternative 2.

Two extraction wells would be used at a lower extraction rate of up to 20 gallons per minute (gpm) per well. Because of the use of in situ treatment, it is expected that the extraction wells would be mainly used to contain the plume. Compared to Alternative 2, this would reduce the potential for plume commingling.

If reductive dechlorination is used, about 240 temporary injection points would be used to inject the dechlorination agent. For cost estimating purposes, it was assumed that HRC® (a proprietary reductive dechlorination agent) would be used. If chemical oxidation is used, the oxidizing reagent (e.g., sodium permanganate) would be injected in approximately 160 temporary injection points. Subsequent injections may be needed for successful treatment. Implementation would temporarily disturb traffic on Rayo Avenue and other activities on site and off site, and would require special permits and coordination with the city of South Gate.

Containment Components

Treated water could be reinjected into the groundwater aquifer or discharged to a POTW. The purpose of the limited extraction/treatment system would be to contain further plume migration, minimize potential mixing with other VOC plumes, and clean up residual VOC concentrations to meet the remedial action goals.

Monitoring Components

Similar to Alternative 2, groundwater monitoring will be used to gauge the success of the remedial action. Depending on the rate of contaminant reduction, monitoring may become the only action at Cooper Drum. Monitored natural attenuation could be employed if it can be demonstrated that contaminant concentrations in the groundwater plume have stabilized at reduced concentrations. The estimated cost for this alternative is based on a project duration of 20 years.

Required O&M

O&M activities for VOC treatment using extraction systems and the liquid GAC treatment facilities are the same as for Alternative 2. There is no O&M associated with in situ treatment.

Expected Outcomes

The contaminated groundwater under Cooper Drum is semi-confined in the upper aquifer. Implementation of groundwater Alternative 4 would remove VOC contamination above drinking water standards in the shallow aquifer and would protect the existing beneficial use of the currently uncontaminated deeper aquifers.

9.2.4 Groundwater Alternative 6 - In-Well Air Stripping with Groundwater Circulation Wells

Treatment Components

Alternative 6 applies a physical treatment technology through in situ treatment of VOCs in groundwater. It consists of installing an estimated 34 groundwater circulation wells (GCWs) within the groundwater plume down to 100 feet below the surface. The GCWs are used to achieve in-well air stripping by injecting air into the bottom of the well. This process promotes the circulation of groundwater through the well. Air rises through the groundwater and "strips" (removes) the VOC contaminants. The contaminated vapor is then passed through an aboveground treatment system that uses GAC to remove the VOCs. The treated vapor, from which VOCs have been removed, is discharged to the air.

Due to the uncertainty regarding the effectiveness of using GCWs at Cooper Drum, a treatability study would be required to measure the effectiveness of this technology. The treatability study results could then be used to refine the placement and operation of the GCWs. The advantage of this technology would be the in situ treatment of all the groundwater contaminants without the need to extract, treat, and discharge any groundwater. The main disadvantages are the high potential for scale buildup and biofouling in the underground wells and treatment system and the reliance of the technology on the formation of groundwater circulation zones to effectively capture and treat contamination.

Operation and Maintenance Components

Operation and maintenance of the GCWs underground could be difficult and costly, since there is a high potential for scaling and biofouling inside the GCWs. O&M cost estimates are higher for this alternative as compared to the others.

Monitoring Components

Costs associated with this alternative are based on a project duration of 20 years. These costs could be substantially lower or higher depending on the results of a pilot-scale test, which would indicate the number of wells that would be needed to reach remedial action goals. Sampling of the groundwater monitoring wells would occur at the same frequency as Alternatives 2 and 4.

Required O&M

O&M activities for VOC treatment are related to upkeep of the GCWs and the closed loop treatment systems, including controls and communications systems, mechanical components (e.g., blowers, flow meters, heat exchanger, valves, connections), disposal of spent GAC and recharging of the GAC vessels, pipeline maintenance, prevention and treatment of scale buildup inside pipelines and pipeline components, groundwater circulation well maintenace (may include acid dripping to prevent scale buildup), monitoring well maintenace, grounds upkeep, and reporting of spills, uncontrolled emissions, or other anomalous occurrences.

Expected Outcomes

The contaminated groundwater under Cooper Drum is semi-confined in the upper aquifer. Implementation of groundwater Alternative 6, if shown to be effective in treatability studies during the RD, would remove VOC contamination above drinking water standards in the shallow aquifer and would protect the existing beneficial use of the currently uncontaminated deeper aquifers.

9.3 Common Elements and Distinguishing Features of Each Alternative

Common elements to soil Alternatives 2 and 3 include:

- Reduction of volume and mobility of the VOCs in the soil.

- Use of DPE for treating VOC contamination in soil and groundwater.

- Implementation of institutional controls, however, under Alternative 3 would only need to be in place if non-VOC contamination beneath structures remains on site.

- Attainment of ARARs.

The distinguishing element of Alternative 3 is the inclusion of excavation for removal of shallow soil contaminated with non-VOCs. Alternative 3 is more reliable in the long term because most, if not all, of the non-VOC contamination will be permanently removed off site. Any residual contamination will be in inaccessible areas beneath existing structures and not a health hazard for above ground activities. Subsurface activities would be restricted by implementing institutional controls. The excavation activities under Alternative 3 are likely to disrupt ongoing site operations for over two months.

Common elements to groundwater Alternatives 2, 4, and 6 include:

- Reduced volume and mobility of the VOCs in groundwater.

- Use of GAC for treatment of VOCs.

- Alternatives 2 and 4 have reinjection or discharge to the local publicly owned treatment works (POTW) as groundwater disposal options.

- Attainment of ARARs.

The distinguishing elements include:

- Alternative 2 uses only ex situ physical treatment.

- Alternative 4 uses lower extraction rates compared to Alternative 2.
- Alternative 4 uses both ex situ physical and in situ chemical treatment.

- Alternative 6 used only in situ physical treatment. Construction of 34 GCWs and the aboveground treatment facilities in Alternative 6 is expected to take longer than construction activities associated with alternatives 2 and 4.

- Implementation of Alternatives 4 and 6 would entail evaluation of the in situ treatment in pilot-scale treatability studies.

- Implementation of Alternatives 2 and 4 is expected to provide better groundwater plume control and containment, resulting in more long term reliability.

Table 9-1 summarizes the cost, number of extraction and injection wells, treatment flows, and number of years to achieve RAOs for the soil and groundwater alternatives.

Table 9-1
Summary of General Comparison Information for Each Alternative

Alternative	Media	20 Year Present Value Cost ($million)	Number of Extraction Wells	Total Groundwater Treatment Flow (gpm)	Number of Reinjection Wells	Estimated Time to Achieve RAO (years)
Soil Alternative 2	soil	1.28	3	9 (150 scfm for soil vapor)	0	5-20 [a]
Soil Alternative 3	soil	2.77	3	9 (150 scfm for soil vapor)	0	5 [b]
Groundwater Alternative 2	groundwater	3.53 to 4.08 [c]	3	99	3	20
Groundwater Alternative 4	groundwater	5.36	2	40	1	up to 20 [d]
Groundwater Alternative 6	groundwater	6.59	34	0	0	20

a Based on institutional controls to eliminate exposure pathways from non-VOC contaminated soil.
b Based on excavation and off-site disposal to eliminate exposure pathways from non-VOC contaminated soil.
c The cost range is associated with different discharge options.
d Remediation may be expedited compared to Groundwater Alternative 2 because of the addition of in situ chemical treatment.

10.0 Comparative Analysis of Alternatives

In accordance with the NCP, the soil and groundwater alternatives were evaluated by the EPA using the nine criteria described in Section 121(b) of CERCLA. For an alternative to be an acceptable remedy it must, at a minimum, satisfy the statutory requirements of two threshold criteria: 1) Overall Protection of Human Health and the Environment, and 2) Compliance with Applicable or Relevant and Appropriate Requirements. "No Action" (Alternative 1) for soil and groundwater is the only retained alternative that does not satisfy these threshold criteria. Therefore, this alternative will not be further evaluated in the comparative analysis.

In addition to the discussion in the following paragraphs, the comparative analysis of soil Alternatives 2 and 3, and groundwater Alternatives 2, 4, and 6 are summarized in Table 10-1.

10.1 Overall Protection of Human Health and the Environment

This criterion addresses whether each alternative provides adequate protection of human health and the environment and describes how health risks are eliminated, reduced, or controlled, through treatment, engineering controls, and/or institutional controls.

10.1.1 Soil Alternatives

Alternatives 2 and 3 are protective of human health and the environment. VOC contamination will be treated to meet remedial action goals. Institutional controls will prevent exposure to non-VOC contamination remaining in the subsurface. Existing pavement maintenance is necessary to ensure total protectiveness and prevent exposing individuals to existing contamination. Alternative 3 would provide additional protection from possible exposure to non-VOCs by removing contaminated soil above action levels from Cooper Drum.

Table 10-1 Comparative Analysis of Soil and Groundwater Remedial Action Alternatives With Respect to CERCLA Criteria					
Criterion	**Soil Alternative 2**	**Soil Alternative 3 (Selected Remedy)**	**Groundwater Alternative 2**	**Groundwater Alternative 4 (Selected Remedy)**	**Groundwater Alternative 6**
Overall protectiveness	Protective	Protective	Protective	Protective	Protective
Compliance with ARARs	Does not comply with ARARs for non-VOCs	Better; complies with ARARs for VOCs and non-VOCs	Complies with ARARs	Complies with ARARs	Complies with ARARs provided recirculation zones are formed.
Long-term effectiveness and permanence	Effective for VOCs. Effective for non-VOCs while institutional controls are in place and pavement is maintained in good condition	More effective for non-VOCs; shallow and accessible non-VOC contamination will be permanently removed	Effective; groundwater with COC levels above action levels will be treated	Potentially more effective; supplemental in situ treatment may expedite cleanup	Stand alone in situ technology may be effective if recirculation zones are formed and scaling is prevented
Reduction in toxicity, mobility, or volume through treatment	Does not reduce toxicity or volume of non-VOCs	Better for non-VOCs; volume of non-VOC contamination will be reduced	Reduces volume of COCs	Potentially better; also reduces toxicity of COCs in place	Reduces volume of COCs if recirculation zones are formed
Short-term effectiveness	VOC treatment within 2 years. Well construction must not create conduits for vertical migration of COCs. Soil gas emissions must be effectively controlled	Same as Alternative 2. Fugitive dust and soil gas emissions during excavation and transport must be controlled. Workers must be properly attired	Appreciable short-term results are not expected. Potential commingling with off-site plumes. Well construction must not create conduits for vertical migration of COCs	Better; supplemental in situ treatment may expedite cleanup. Lower potential for plume commingling.	Some increase in VOC levels may be observed initially. Well construction must not create conduits for vertical migration of COCs
Implementability	Construction will temporarily disturb surface structures and activities. Transport of waste off site is required. Institutional controls will require that an appropriate entitiy (e.g. DTSC) be willing to accept and enforce the restrictive covenant to be executed by the property owners.	Same as Alternative 2, plus transport will also be required for excavation and off-site disposal of contaminated soil	Anti-degradation policies may apply if treated water is reinjected. Construction activities will temporarily disturb surface structures and some activities at Cooper Drum. Waste discharge conditions from the RWQCB are required	Same as Alternative 2, plus numerous (temporary) injection points will disturb surface structures, activities, and traffic on- and off-site. Waste discharge conditions will be required for injection of chemicals and treated water	Worse; installation of numerous (permanent) wells and associated piping will disturb surface structures and activities both on- and off-site. An above-ground treatment plant with sound-proof enclosure is required. Waste discharge conditions are required
Present worth capital cost ($1,000)	$460	$1,946	$447 [a] $638 [b]	$2,451	$2,734
Annual O&M cost ($1,000)	$47	$47	$220 [a] $247 [b]	$208	$261
Total present worth cost ($1,000) [c]	$1,284	$2,770	$3,529 [a] $4,077 [b]	$5,364	$6,589

(a) Treated water discharged to POTW.

(b) Treated water reinjected into aquifer.

(c) Present worth cost estimates are based on 2001 dollars and were calculated using a 7% discount rate. Remedial action start year was assumed to be 2003, and the duration of remedial action was set to 20 years. The cost of 3 years of post-remedial action compliance monitoring was included for all action alternatives.

ARAR applicable or relevant and appropriate requirements
COC chemical of concern
O&M operation and maintenance
VOC volatile organic compound

10.1.2 Groundwater Alternatives

With regards to treatment of COCs above action levels, Alternatives 2 through 6 would be protective. Groundwater VOC contamination above remedial action goal levels would be extracted or stripped and treated using GAC. The health risk from any remaining contamination would be negligible.

Alternatives 3 through 5 which include use of in situ chemical treatment in addition to ex situ treatment are expected to expedite the destruction of hazardous VOCs in the groundwater.

Regarding plume containment, Alternatives 2 and 4 which include use of extraction, treatment, and reinjection of groundwater, or "pump-and-treat" response action, would be more effective than Alternative 6 which is strictly an in situ response action.

10.2 Compliance with Applicable or Relevant and Appropriate Requirements

Section 121(d) of CERCLA and NCP §300.430(f)(1)(ii)(B) require that remedial actions at CERCLA sites at least attain legally applicable or relevant and appropriate federal and state requirements, standards, criteria, and limitations which are collectively referred to as ARARs, unless such ARARs are waived under CERCLA §121(d)(4).

Applicable requirements are those cleanup standards, standards of control, and other substantive requirements, criteria, or limitations promulgated under federal environmental or state environmental or facility siting laws that specifically address a hazardous substance, pollutant, contaminant, remedial action, location, or other circumstance found at a CERCLA site. Only those state standards that are identified by a state in a timely manner and that are more stringent than federal requirements may be applicable. Relevant and appropriate requirements are those cleanup standards, standards of control, and other substantive requirements, criteria, or limitations promulgated under federal environmental, state environmental, or facility siting laws that, while not "applicable" to a hazardous substance, pollutant, contaminant, remedial action, location, or other circumstance at a CERCLA site address problems or situations sufficiently similar to those encountered at the CERCLA site that their use is well suited to the particular site. Only those state standards that are identified in a timely manner and are more stringent than federal requirements may be relevant and appropriate.

Compliance with ARARs addresses whether a remedy will meet all of the applicable or relevant and appropriate requirements of other federal and state environmental statutes or provides a basis for invoking a waiver. None of the soil or groundwater alternatives required a waiver for ARARs.

Soil Alternatives 2 and 3 have common ARARs associated with the DPE, GAC, and institutional controls. The use of DPE for VOCs in soil includes compliance with emission standards for volatile organics. Soil Alternative 2 would depend on institutional controls to eliminate the residential exposure pathway for non-VOC soil contaminants. Soil Alternative 3 includes the added component of excavation and off-site disposal of non-VOC-contaminated soil to protect human health. Acquisition of permits would not be necessary for on-site treatment operations.

Groundwater Alternatives 2, 4, and 6 would meet all of the ARARs. These groundwater alternatives rely on treatment to reduce toxicity and mobility of the VOCs in groundwater. Groundwater Alternatives 2 and 4 would discharge treated groundwater to the aquifer or the local POTW. A permit would be necessary for off-site discharge of treated water to the POTW; treatment would comply with the local sewer discharge limitations and fee requirements.

All of the ARARs for the selected remedy are presented in the Statutory Determinations (40 CFR §300.430(f)(5)(ii)(B)).

10.3 Long-Term Effectiveness and Permanence

This criterion refers to the ability of a remedy to maintain reliable protection of human health and the environment over time, once cleanup levels have been met. This criterion includes the consideration of residual risk that will remain on-site following remediation and the adequacy and reliability of controls.

10.3.1 Soil Alternatives

With regards to VOCs, Alternatives 2 and 3 would provide long-term effectiveness because the remediation would continue until VOC levels fall below remedial action goal levels. Once remedial action goals are achieved, compliance monitoring will provide an early warning if contamination rebound is observed. Dual phase extraction is recognized as an enhancement to the "presumptive remedy" of SVE which implies that the process has been shown to be widely effective and permanent.

With regards to non-VOCs, institutional controls under Alternative 2 would be effective so long as the administrative restrictions and access controls remain in place, and the pavement (capping) is maintained. However, contaminated soil would remain as a potential source of groundwater contamination. Alternative 3 (the selected remedy) would be more effective because, where possible, soil contaminated with non-VOCs above action levels would be permanently removed from Cooper Drum, thus reducing potential health risks.

Five-year reviews would be necessary to evaluate the effectiveness of either alternative because hazardous substances would remain in the subsurface where excavation is not deemed feasible.

10.3.2 Groundwater Alternatives

Over the long-term, Alternatives 2 and 4 would provide an effective means of controlling the migration of the existing contaminant plume in the Gaspur Aquifer. The contamination in the groundwater would be permanently reduced because remedial action would continue until RAOs were met. Once RAOs are achieved, compliance monitoring would provide an early warning if contamination rebound were observed. (If treated water is reinjected, care must be taken to prevent fouling and scaling of the injection wells over time.)

The long-term effectiveness of Alternative 6 is uncertain since it is dependent upon successful implementation of the groundwater circulation wells and formation of the recirculation cells under site conditions. In addition, in-well scale formation must be avoided if this alternative is to be effective. Compared to Alternatives 2 and 4, Alternative 6 is the only remedy that does not include a pump-and-treat component and utilizes only in situ technology. Plume control will be possible only if recirculation cells are effectively established. Additional wells may be required downgradient of the plume for added plume control.

10.4 Reduction of Toxicity, Mobility, or Volume Through Treatment

This CERCLA criterion refers to the anticipated performance of the treatment technologies that may be included as part of a remedy. Remedial actions that use active treatment to permanently and significantly reduce the toxicity, mobility, and volume of contamination satisfy this criterion.

10.4.1 Soil Alternatives

Through active treatment, Alternatives 2 and 3 would equally reduce the toxicity, mobility, and volume of VOC contamination in soil. VOCs above action levels would be extracted from the soil and adsorbed onto GAC. The VOCs would be permanently destroyed in the likely event that the spent carbon is eventually reactivated by the carbon vendor.

Alternative 3 (the selected remedy) is more effective with respect to this CERCLA criterion, however. By removing non-VOC contamination above action levels in accessible areas, Alternative 3 would permanently reduce the volume of non-VOC contamination in Cooper Drum subsurface. The excavated soil would be disposed in a landfill, where the contaminants would be actively destroyed or, at a minimum, encapsulated, resulting in reduced mobility.

10.4.2 Groundwater Alternatives

Alternatives 2 and 4 would reduce the toxicity, mobility, and volume of COCs through active treatment (adsorption onto liquid-phase GAC). The spent GAC would be removed from Cooper Drum and likely reactivated, resulting in eventual destruction of the COCs.

In addition to the pump-and-treat action of Alternative 2, Alternatives 4 includes the use of in situ technologies which, if effective, would chemically react with the COCs, thus reducing the volume and toxicity of these compounds in the groundwater. This would reduce the contamination load on the GAC treatment system.

With regards to non-COCs which may be present at high background concentrations (e.g., arsenic), discharge to POTW would result in removal of the contaminants from the Cooper Drum subsurface, whereas reinjection of the treated groundwater would not.

Alternative 6 would reduce the toxicity, mobility, and volume of COCs in groundwater, by stripping the VOCs, followed by adsorption of the VOCs onto GAC. However, the effectiveness of this remedy would be undermined if the groundwater circulation wells produced scale or if recirculation zones did not form effectively. Because of the proven pump-and-treat component, Alternatives 2 and 4 are expected to be more effective in extracting and permanently removing VOCs from the groundwater.

10.5 Short-Term Effectiveness

This criterion addresses the period of time needed to implement the remedy and any adverse impacts that may be posed to workers, the community, and the environment during construction and operation of the remedy until cleanup levels are achieved.

10.5.1 Soil Alternatives

Remedial action goals for VOCs may be achieved within two years of startup if either Alternative 2 or 3 is implemented. However, periods of system shutdown and contamination rebound, followed by additional extraction, may lengthen the duration of remedial action. Care must be taken during construction of the extraction and vapor monitoring wells and conveyance piping to minimize/prevent soil gas emissions. The vapor-phase GAC must be designed so as to create no air emissions. Furthermore, well construction must be completed so as not to create a "conduit" through which contamination can migrate vertically.

Both Alternatives 2 and 3 include use of institutional controls to a different extent as a means of preventing exposure to the non-VOC contamination in soil. These controls are expected to remain in place until subsurface contamination is removed or otherwise no longer deemed hazardous.

If Alternative 3 is implemented, excavation and disposal of non-VOC contaminated soil above action levels is expected to be completed in a matter of months. Care must be taken to control fugitive dust and/or soil gas emissions during soil excavation and transport activities. Workers would be required to wear appropriate levels of protection to avoid exposure during excavation and transport activities.

10.5.2 Groundwater Alternatives

Appreciable short-term results (e.g., in less than a year) are generally not associated with the extraction/GAC treatment component of Alternatives 2 and 4. However, some reduction in mass and mobility of contamination is expected as groundwater is removed and treated. With regards to negative short-term effects, well construction must be completed so as not to create a "conduit" through which contamination can migrate vertically. Since liquid-phase GAC would be used, no air emissions are associated with use of this alternative.

Because of the higher extraction rates, there is a higher potential for commingling of plumes on site and off site if Alternative 2 is implemented.

Implementation of Alternative 4 may entail use of an oxidizing reagent for in situ oxidation of groundwater COCs. Oxidation of most COCs is expected to be rapid and effective. During application, skin contact with the oxidizing solution, and inhalation of any dust or vapors should be avoided. Workers should use protective gear and clothing. In some cases, oxidation may temporarily inhibit growth of anaerobic bacteria in the groundwater, which in turn may adversely affect biodegradation of the contaminants. Also, in the short-term, because of increased mobility, the concentrations of some metals may increase. The concentrations would eventually return to background concentrations. Well construction must be completed so as not to create a "conduit" through which contamination can migrate vertically. The pump-and-treat component of Alternative 4 must be designed so as to provide adequate hydrologic control of the injected oxidizing solution.

In situ reductive dechlorination is a component of Alternatives 4. If HRC® is used and is effective, dechlorination of COCs should occur within 6 months of application. Application may be completed over a 12-week period. In situ reductive dechlorination, by definition, relies on biodegradation processes for breakdown of the COCs. In the short-term, some increase in concentrations of TCE breakdown byproducts (e.g., cis, 1-2, DCE and VC) may occur. If necessary, under Alternative 4, chemical oxidation of these compounds would occur fairly quickly if in situ oxidation is used following HRC® application.

If groundwater recirculation zones are formed effectively upon implementation of Alternative 6, some short-term removal of VOCs may be expected. Initially, some increase in VOC concentrations may be noticed, as VOCs volatilize and desorb from the soil formation. Groundwater circulation well construction must be completed so as not to create a conduit through which contamination can migrate vertically. The vapor phase GAC treatment must be designed so as to eliminate the potential for air emissions.

10.6 Implementability

Implementability addresses the technical and administrative feasibility of a remedy from design through construction and operation. Factors such as availability of services and materials, administrative feasibility, and coordination with other governmental entities are also considered.

10.6.1 Soil Alternatives

Both Alternatives 2 and 3 are technically feasible and implementable. All materials and services needed for implementation are readily and commercially available.

With regards to VOC treatment, some interference with ongoing business activities at Cooper Drum is expected because implementation of the extraction/DPE system would result in the installation of extraction wells and related conveyance piping, and the construction of an aboveground treatment plant. A permit would be required for off-site discharge of the extracted water to the POTW. Implementation would result in disruption of roads and surface structures to accommodate the aboveground and buried systems. Operation and maintenance of the system would include cleaning and replacement of well components, disposal and replacement of activated carbon, and maintenance of pumps, controls, and other equipment.

With regards to non-VOCs in soil, implementation of institutional controls will require cooperation by the state (DTSC) or local government, since some appropriate entity must agree to accept and enforce the restrictive covenant. Both Alternative 2 and Alternative 3 rely to some extent on institutional controls.

The excavation component of Alternative 3 is implementable and technically feasible. However, soil excavation would result in disruption of surface structures (pavement, etc.) over the short-term. Excavation would not be implementable or feasible for areas where contamination is found to be too deep or under existing structures. Transport of the excavated soil to an off-site landfill would be required.

10.6.2 Groundwater Alternatives

Implementation of all groundwater alternatives is technically feasible and all materials and services needed for implementation are readily and commercially available.

The extraction/treatment component of Alternatives 2 and 4 would result in the installation of wells and related conveyance piping, and the construction of an aboveground treatment plant. Coordination with the City of South Gate would be required to install treatment system components which may disrupt traffic. Additionally, because non-COCs would not be treated below MCLs, reinjection of treated water would require coordination with the RWQCB. EPA's position is that reinjection of water with non-COCs at background levels would be acceptable, so long as the treated water is reinjected back into the same aquifer, not far from where it was extracted. Discharge of groundwater to the POTW may be acceptable if reinjection is not feasible or the discharge volume is small (e.g., in the case of Alternative 4). Discharge limits would have to comply with off-site permit requirements in either case. Operation and maintenance of the system would include cleaning and replacement of well components, disposal and replacement of activated carbon, and maintenance of pumps, controls, and other equipment.

Implementation of Alternative 4 would additionally entail injecting a reagent into many temporary injection points located in areas of activity. For technical feasibility, care must be taken to inject the reagent such that there is adequate overlap of the radii of influence between consecutive injection points. This frequency of injection points would cause disruption of site activities and traffic, and impact surface structures. Coordination with City of South Gate officials would be required. Discharge conditions from the RWQCB would be required to allow for injection of the reagents and water into the subsurface.

Some interference with ongoing business activities at Cooper Drum is expected with implementation of Alternative 6 because it would result in the installation of numerous permanent groundwater circulation wells and related conveyance piping both on site and off site, and the construction of an aboveground treatment plant on site. Coordination with the City of South Gate would be required to install treatment system components which may disrupt traffic. Any water discharges would need to be coordinated with the appropriate agencies. A soundproof building would be required to house the blowers. The most difficulty could be from having to keep the treatment system, the wells, and the conveyance piping free of scale. Operation and maintenance of the system would also include cleaning and replacement of well components, disposal and replacement of activated carbon, and maintenance of pumps, controls, and other equipment.

10.7 Cost

Table 10-1 lists the capital, annual O&M, and total present worth cost estimates for the soil and groundwater alternatives.

10.7.1 Soil Alternatives

Because of the added capital cost associated with the excavation component, the total present worth cost for Alternative 3 ($2.77 million) is more than twice that of Alternative 2 ($1.29 million). However, the difference in cost will be less if the actual volume of excavated soil is less than assumed, or if some of the excavated uncontaminated soil can be used for refill or can be transported to a Class II landfill.

The annual O&M cost for both alternatives is equivalent because these costs are associated with the operation and maintenance of the extraction/treatment systems and implementation of the institutional controls.

10.7.2 Groundwater Alternatives

The estimated present worth costs for the groundwater alternatives, not including the No Action alternative, range from a minimum of $3.53 million for Alternative 2 (when using POTW discharge) to $6.59 million for Alternative 6. All costs are based on a 20-year duration for remedial action.

Although the projected cost for implementing Alternative 4 (the selected remedy) is shown to be higher than that for Alternative 2, the following items should be taken into perspective for a fair comparison:

1) The use of in situ treatment in addition to the pump-and-treat action may expedite cleanup, to such a level that the overall cost of implementation of Alternative 4 is less than Alternative 2.

2) It is likely that only one in situ treatment - oxidation or reductive dechlorination, whichever is found to be more effective during treatability studies - will actually be used as part of Alternative 4.

3) The extent of in situ treatment (i.e., amount of material used, number of injection points, and frequency of applications) may be less than projected, such that the implementation cost for Alternative 4 is less than estimated.

Because the pump-and-treat component of Alternative 4 is less extensive than that for Alternative 2, the associated annual O&M costs are expected to be far less.

10.8 State Acceptance

The State of California Department of Toxic Substances Control and the Los Angeles Regional Water Quality Control Board have concurred with EPA's preference for soil Alternative 3 and groundwater Alternative 4.

10.9 Community Acceptance

During the public comment period for the Proposed Plan, no written comments were received. Questions that were raised at the Public Meeting were addressed by EPA staff. There were no significant issues or objections directed toward the selected remedy. EPA believes that the selected remedy addresses the community concerns that were identified during community interviews. The main concern was that the selected remedy should not include incineration of contaminants, which could further impact air quality conditions. The selected remedies for soil and groundwater do not include incineration of contaminants and will not adversely impact air quality; therefore, community concerns have been addressed.

11.0 Principal Threat Wastes

The NCP establishes EPA's expectation that treatment be used to address the principal threats posed by a site wherever practical. The principal threat concept applies to the source materials at a Superfund site that are highly mobile and cannot be reliably controlled in place, or would present a significant risk to human health or the environment should exposure occur. A source material is material that includes or contains hazardous substances, pollutants, or contaminants that act as a reservoir for migration of contamination to groundwater, surface water, or air or act as a source for direct exposure.

Although treatment will be applied to the VOC contaminated soil and groundwater, there are no principal threats at Cooper Drum. The VOC soil contaminants are mobile and act as a potential threat to groundwater but are low in concentration. The non-VOC soil contaminants pose a risk to human health but are not mobile and are characterized by relatively low concentrations within a confined area. Groundwater contamination at Cooper Drum is at low concentrations and not considered to be a source material. NAPLs have not been detected in the groundwater.

12.0 Selected Remedy

The remedial action for Cooper Drum addresses contaminated soil and groundwater. To remove the potential threat to human health, the selected remedy for soil (Alternative 3) uses dual phase extraction (DPE) for treatment of volatile organic compounds (VOCs) in soil. Other non-VOC soil contaminants, including semi-volatile organic compounds (SVOCs), PCBs, and lead, will be excavated for disposal. Institutional controls will be implemented to prevent exposure to soil contaminants where excavation is not feasible.

The cleanup strategy for groundwater contaminated with VOCs (Alternative 4) will use a combination of methods to achieve remedial goals and to restore the potential beneficial use of the aquifer as a drinking water source.

An ex situ treatment component, consisting of a groundwater extraction and treatment system, will be used for containment and remediation. This ex-situ treatment component will utilize presumptive technologies identified in Directive 9283.1-12 from EPA's Office of Solid Waste and Emergency Response (OSWER). Since the COCs in groundwater are volatile, one of the presumptive technologies (GAC) will be used for treating aqueous contaminants in the extracted ground water.

In situ chemical treatment - reductive dechlorination and/or oxidation - will also be used to enhance the treatment of VOCs in groundwater and to minimize the need for extraction and ex situ treatment.

The actual technologies and sequence of technologies used will be determined during remedial design (RD). Final selection of these technologies will be based on the outcome of treatability studies to be performed during the RD.

The EPA believes the selected remedy for Cooper Drum meets the threshold criteria and provides the best balance of tradeoffs among the alternatives considered. The EPA expects the selected remedy to satisfy the statutory requirements of CERCLA Section 121(b): 1) protection of human health and the environment: 2) compliance with ARARs; 3) cost effectiveness; 4) use of permanent solutions and alternative treatment technologies to the maximum extent practicable; and 5) use of treatment as a principle component.

12.1 Summary of the Rationale for the Selected Remedy

The principal factors considered in choosing the selected remedy for soil are:

1) VOCs in soil are mobile but are low level threats to human health since they exist at relatively low concentrations and can be contained;

2) DPE, an enhancement of the presumptive remedy of soil vapor extraction (SVE), can be used to simultaneously treat the VOCs in the soil and in the perched aquifer which starts at about 35 ft below ground surface (bgs);

3) Excavation and disposal of shallow soil will be effective because non-VOCs in shallow soil are not mobile and are localized in a confined area;

4) Use of institutional controls will eliminate/minimize the potential for exposure to any residual subsurface contamination; and

5) The selected remedy is protective of human health and environment and complies with ARARs for VOCs and non-VOCs.

The principal factors considered in choosing the selected remedy for groundwater are:

1) There is no source material or non-aqueous phase liquids (NAPLs) in the groundwater constituting a principal threat;

2) Low level extraction provides an effective means of minimizing migration of the leading edge of the contaminant plume, without further commingling of on- and off-site plumes;

3) Reinjection of a portion of the treated ground water will enhance recovery of contaminants from the aquifer and will reduce the plume commingling potential;

4) Supplemental in situ chemical treatment may expedite cleanup and reduce volume and toxicity of contaminants in place; and

5) Depending on the success of the in situ chemical treatment, monitoring may become the only action needed at Cooper Drum within 5 to 10 years if it can be demonstrated that contaminant concentrations in the groundwater plume have stabilized at reduced concentrations.

12.2 Description of the Selected Remedy

Selected Remedy for Soil

The selected remedy for soil is Alternative 3. This alternative uses DPE to treat VOCs in soil, excavation and off-site disposal to remove non-VOCs in shallow soil, and institutional controls to limit future use of Cooper Drum in areas where soil excavation is not feasible. The components of the selected remedy are as follows:

- In the former hard wash area (HWA), extract VOC contaminated soil vapor and groundwater simultaneously using dual phase extraction (DPE) technology. Treat the extracted soil vapor and groundwater using vapor and liquid phase carbon in vessels at an on-site treatment plant.

- After removal of VOCs, discharge the treated soil vapor into the air. The treated water will be reinjected into the aquifer or discharged to the public sewer system operated by the Los Angeles County Sanitation District.

The total duration of the DPE remedial action is projected to be five years. Actual operation of the DPE system is estimated to be two years. It is assumed that vapor monitoring wells and groundwater extraction wells would continue to be sampled for at least three more years to ensure remedial action goals have been met.

- Conduct additional soil gas sampling in the drum processing area (DPA) during the remedial design (RD) phase to further identify the extent of VOC contamination and the need for remediation using dual phase extraction in this area.

- In the HWA and DPA, excavate an estimated 2,700 tons of non-VOC contaminated shallow soil (estimated down to five feet in depth) for disposal at an approved off-site facility. Use clean soil to backfill excavated areas.

- Conduct additional soil sampling in the DPA and HWA during the RD phase to further define the extent of non-VOC contamination and the need for remediation beyond the estimated 2,700 tons of soil.

- Implement institutional controls for soil contaminated with non-VOCs in areas where excavation is not feasible, such as under existing structures, by requiring the execution and recording of a restrictive covenant which will limit activities that might expose the subsurface and would prevent future use, including residential, hospital, day care center and school uses, as long as contaminated soil remains on site.

The objectives of institutional controls for Cooper Drum are:

1) To provide notification to all potential future site users of the presence of hazardous materials (soil contaminated with non-VOCs) in those areas of Cooper Drum where excavation was not feasible.

2) To minimize the potential for exposure of future site users to contaminated soils left on site after completion of this Remedial Action.

3) To prevent disturbance of contaminated soils left on site after completion of this Remedial Action by drilling or construction in contaminated areas.

4) To expressly prohibit residential land use on any part of Cooper Drum and limit future uses of Cooper Drum to commercial and industrial activities unless, and until all contaminated soil left on Site after the completion of this Remedial Action has been treated to safe residential levels or excavated and removed from Cooper Drum.

To achieve these objectives, EPA intends to require the legal owners of Cooper Drum to execute and record a restrictive covenant addressing these objectives. The restrictive covenant shall run with the land and be enforceable under California law (including California Civil Code Section 1471) against all present and future property owners and tenants. EPA and/or the State of California DTSC (the State) shall oversee compliance with the use restrictions.

The land use restrictions in the restrictive covenant shall include compliance with all the following provisions:

a) Construction not approved by EPA or the State that impacts contaminated soils left in place shall not occur.

b) No new openings shall be made in floor slabs in buildings or structures overlying contaminated soils left in place without the prior written approval of EPA or the State.

c) The integrity of existing foundations shall be maintained in areas underlain by contaminated soils left in place. All cracks or other damage in such foundations shall be reported to EPA or the State.

d) Present and future owners of Cooper Drum or any portion thereof shall disclose all institutional controls to all tenants on the property.

e) Present and future owners of Cooper Drum or any portion thereof shall inform EPA or the State of the identities of all tenants on the property.

f) Contaminated soils left on site shall not be excavated without the written approval and supervision of EPA or the State.

g) No portion of Cooper Drum shall be used or redeveloped for residential use, used as a hospital, day care center or school unless and until contaminated soils left on site have been treated to safe levels for such uses or excavated and removed from Cooper Drum as certified by EPA or the State. When and if, through excavation of soils or otherwise, the entire site is rendered safe for unrestricted use, EPA and/or the State will consider removal of the restrictive covenant from the chain of title to the property comprising Cooper Drum.

Selected Remedy for Groundwater

The selected remedy is groundwater Alternative 4. This alternative consists of extracting VOC-contaminated groundwater and treating it with liquid-phase activated carbon. In situ chemical treatment - reductive dechlorination or chemical oxidation - would be used to expedite and enhance treatment, and to reduce the volume of extracted water. The various components of the selected remedy are:

- Extract groundwater contaminated with VOCs and treat it using liquid-phase activated carbon in vessels at an on-site treatment system. Containment will be provided at the downgradient extent of contamination.

- The treated water will be reinjected into the contaminated groundwater aquifer or discharged to the public sewer system operated by the Los Angeles County Sanitation District. Reinjection will reduce the intrusion of and the potential for mixing with other off-site VOC plumes.

- Use in situ chemical treatment, either reductive dechlorination or chemical oxidation, to enhance remediation of VOC-contaminated groundwater. During the remedial design (RD) phase, conduct treatability studies to evaluate both methods and determine which works best under site conditions. Data obtained from pilot studies will also be used to determine the specific number and placement of in situ injection points.

- Conduct additional groundwater sampling during the RD phase to further define the downgradient extent of the VOC contamination.

- Conduct groundwater monitoring to evaluate the effectiveness of the remedy, the location of the plume, and that remediation goals have been met.

Continue groundwater monitoring for a period of three years after the monitoring demonstrates that remediation goals have been met. The projected time to reach remedial action goals is 20 years. However, the actual time required for cleanup may be reduced if the in situ chemical treatment is effective. Depending on the success of in situ chemical treatment, monitoring may become the only action needed at Cooper Drum within 5-10 years. For example, in situ chemical treatment may provide a relatively fast reduction of the contaminant mass in the ground water plume. This mass reduction could lead to stabilization of low contaminant concentrations to the point that containment with extraction wells may no longer be necessary.

12.3 Summary of the Estimated Remedy Costs

The estimated costs for the selected remedy are presented in four tables. Tables 12-1 and 12-2 are cost estimate summary tables for the selected remedy for soil and groundwater, respectively. These tables present the subtotal capital and O&M costs associated with different components of the selected remedy, the subtotal discounted costs, and the total present worth costs for implementation of the remedy. Tables 12-3 and 12-4 list the annual and total present worth cost estimates for the selected remedy for soil and groundwater, respectively.

Uncertainty in Cost Estimates

All assumptions used in calculating the cost estimates are listed in the table footnotes and as follows:

- A remedial action start date of 2003 was assumed in the cost calculations; however, actual start date may be later.
- Overall duration of remedial action was assumed to be 20 years.
- Undiscounted costs were estimated in 2001 dollars.
- A 7% discount rate was used in the present worth analysis.

The major sources of uncertainty in the cost estimates include:

- The treatment technologies: the actual technologies and sequence of technologies used will be determined during remedial design (RD). Final selection of these technologies will be based on the outcome of treatability studies to be performed during the RD.
- The amount of soil that will be excavated and disposed to landfill.
- The number of extraction and injection wells.
- The number of injection points and the amount of chemical reagent needed.
- The amount of water that will be discharged to POTW.
- The extent and duration of monitoring.
- The duration of remedial action.

The cost summary tables are based on the best available information regarding the anticipated scope of the remedial action. Changes in the cost elements are likely to occur as a results of the new information and data collected during the remedial design phase. Major changes may be documented in the form of a memorandum to the Administrative Record file, an ESD, or a ROD amendment. The projected cost is based on an order-of-magnitude engineering cost estimate that is expected to be within +50 or -30 percent of the actual project cost.

Table 12-1
Cost Estimate Summary for the Selected Remedy for Soil

Description	Cost
CAPITAL COSTS	
DPE and vapor monitoring well installation [a]	$286,557
GAC treatment system installation	$27,788
Piping installation	$42,940
Institutional controls	**$8,290**
Soil excavation	$308,237
Soil transportation and disposal to Class I landfill	$872,760
Subtotal (Construction)	**$1,546,572**
Subtotal (Discounted) [b]	**$1,414,730**
Bid contingencies (5% of discounted)	$71,000
Scope contingencies (20% of discounted)	$283,000
Engineering Design (5% of total)	$88,000
Bonding and insurance of construction workers (3% of total)	$53,000
Field and laboratory testing during construction (1% of total)	$18,000
Reporting during construction (1% of total)	$18,000
TOTAL CAPITAL COST (Discounted) [b]	**$1,945,730**
OPERATIONS AND MAINTENANCE COSTS	
Extraction wells	$91,646
Treatment system	$34,282
Discharge piping	$53,024
SVE treatment system and well monitoring	$702,488
Institutional controls	$49,580
Subtotal O&M	**$931,020**
Subtotal O&M (Discounted) [b]	**$823,929**
TOTAL PRESENT VALUE	**$2,769,659**

Notes: Undiscounted costs are based on 2001 dollars and were estimated using RACER™, with an accuracy of -30% to +50%. Costs were based on a 20-year overall duration for remedial action (including 2 years of dual phase extraction, 3 years of compliance monitoring, and 20 years of institutional controls).

a Assumed start date for cost estimating purposes is January 2003. Actual start date may be later.
b A 7% discount rate was assumed.

Table 12-2 Cost Estimate Summary	
Description	**Cost**
CAPITAL COSTS	
Reductive dechlorination (2003) [a,b]	$1,333,494
In situ oxidation (2004)	$304,272
Extraction well and piping installation	$119,731
Treatment system facilities	$47,797
Discharge piping	$6,399
Injection well installation	$31,188
Monitoring well installation	$106,433
Subtotal (Construction)	**$1,949,314**
Subtotal (Discounted) [c]	**$1,783,140**
Bid Contingencies (5%)	$89,000
Scope Contingencies (20%)	$357,000
Total Construction	**$2,229,140**
Engineering Design (5% of total)	$111,000
Bonding and insurance of construction workers (3% of total)	$67,000
Field and laboratory testing during construction (1% of total)	$22,000
Reporting during construction (1% of total)	$22,000
Total Capital Cost	**$2,451,140**
OPERATIONS AND MAINTENANCE COSTS	
Extraction wells	$274,231
Treatment system [d]	$460,069
Injection wells	$140,333
Well monitoring	$2,072,990
Treatment system monitoring	$1,841,781
Subtotal O&M	**$4,789,404**
Subtotal O&M (Discounted) [c]	**$2,912,577**
TOTAL PRESENT VALUE	**$5,363,717**

Notes: Undiscounted costs are based on 2001 dollars and were estimated using RACER™, with an accuracy of -30% to +50%. Costs were based on a 20-year duration for remedial action, plus 3 additional years for compliance monitoring.

a For cost estimating purposes, it was assumed that Hydrogen Release Compound (HRC®) would be used.

b A start date of March 2003 was used in the cost calculations. The actual start date may be later.

c A 7% discount rate was assumed.

d The O&M costs include the cost of discharge of half the water to injection wells and the remainder to POTW.

Table 12-3 Present Worth Cost Analysis for the Selected Remedy for Soil						
Year [a]	Capital Cost	O&M Cost [b]	Inflation [c]	Discount Rate [d]	Inflation Discounted [e]	Present Worth Cost [f]
0	$1,945,730		Included	Included	Included	$1,945,730
1		$607,995	1.0473	0.8734	0.9148	$556,165
2		$260,526	1.0699	0.8163	0.8734	$227,532
3		$11,420	1.0934	0.7629	0.8341	$9,526
4		$6,947	1.1175	0.7130	0.7968	$5,535
5		$6,947	1.1421	0.6663	0.7610	$5,287
6		$2,479	1.1673	0.6227	0.7269	$1,802
7		$2,479	1.193	0.5820	0.6943	$1,721
8		$2,479	1.2194	0.5439	0.6633	$1,644
9		$2,479	1.2463	0.5083	0.6336	$1,571
10		$2,479	1.2734	0.4751	0.6050	$1,500
11		$2,479	1.3006	0.4440	0.5775	$1,432
12		$2,479	1.3278	0.4150	0.5510	$1,366
13		$2,479	1.3549	0.3878	0.5255	$1,303
14		$2,479	1.3821	0.3624	0.5009	$1,242
15		$2,479	1.4093	0.3387	0.4774	$1,183
16		$2,479	1.4365	0.3166	0.4548	$1,127
17		$2,479	1.4636	0.2959	0.4330	$1,073
18		$2,479	1.4908	0.2765	0.4122	$1,022
19		$2,479	1.518	0.2584	0.3923	$ 972
20		$2,479	1.5451	0.2415	0.3732	$925
Total present worth cost				**$2,769,659**		

Notes: Costs were estimated using RACER™, with an accuracy of -30% to +50%.

a Costs were based on a 20-year duration for remedial action.

b O&M costs associated with treatment and monitoring are included for the first five years of remedial action. The O&M costs for remaining years are associated with institutional controls. These costs may be eliminated if institutional controls are limited to ensuring the subsurface is not disturbed or accessed (i.e., if no pavement repairs are implemented).

c Inflation was accounted for because undiscounted costs were based on 2001 dollars. Assumed start date of remedial action was 1 January 2003 but actual start date may be later.

d A discount rate of 7% was used.

e This value is the product of the inflation rate and the discount rate.

f This value is calculated by multiplying the "inflation discounted" by the O&M cost.

Table 12-4
Present Worth Cost Analysis for the Selected Remedy for Groundwater

Year [a]	Capital Cost	O&M Cost	Inflation [b]	Discount Rate [c]	Inflation Discounted [d]	Present Worth Cost [e]
0	$2,451,140		Included	Included	Included	$2,451,140
1		$ 288,250	1.0473	0.8734	0.9148	$ 263,677
2		$ 243,860	1.0699	0.8163	0.8734	$ 212,977
3		$ 230,336	1.0934	0.7629	0.8341	$ 192,135
4		$ 227,432	1.1175	0.7130	0.7968	$ 181,209
5		$ 230,336	1.1421	0.6663	0.7610	$ 175,292
6		$ 231,789	1.1673	0.6227	0.7269	$ 168,496
7		$ 227,432	1.193	0.5820	0.6943	$ 157,914
8		$ 230,336	1.2194	0.5439	0.6633	$ 152,776
9		$ 227,432	1.2463	0.5083	0.6336	$ 144,091
10		$ 237,596	1.2734	0.4751	0.6050	$ 143,742
11		$ 234,208	1.3006	0.4440	0.5775	$ 135,251
12		$ 227,432	1.3278	0.4150	0.5510	$ 125,313
13		$ 230,336	1.3549	0.3878	0.5255	$ 121,031
14		$ 227,432	1.3821	0.3624	0.5009	$ 113,929
15		$ 230,336	1.4093	0.3387	0.4774	$ 109,957
16		$ 231,789	1.4365	0.3166	0.4548	$ 105,408
17		$ 227,432	1.4636	0.2959	0.4330	$ 98,484
18		$ 230,336	1.4908	0.2765	0.4122	$ 94,949
19		$ 227,432	1.518	0.2584	0.3923	$ 89,217
20		$ 237,596	1.5451	0.2415	0.3732	$ 88,662
21		$ 72,845	1.5723	0.2257	0.3549	$ 25,852
22		$ 16,636	1.5995	0.2109	0.3374	$ 5,613
23		$ 16,636	1.6267	0.1971	0.3207	$ 5,335
24		$ 4,159	1.6538	0.1842	0.3047	$ 1,267
Total present worth cost					**$5,363,717**	

Notes: Costs were estimated using RACER™, with an accuracy of -30% to +50%.

a Costs were based on a 20-year duration for remedial action, plus three years of compliance monitoring. Assumed start date of remedial action was 1 March 2003 but actual start date may be later.

b Inflation was accounted for because undiscounted costs were based on 2001 dollars.

c A discount rate of 7% was used.

d This value is the product of the inflation rate and the discount rate.

e This value is calculated by multiplying the "inflation discounted" by the cost.

12.4 Expected Outcome of the Selected Remedy

The selected remedy for soil is expected to remove existing VOC contamination to levels that prevent impact to the aquifer below ground and the indoor air quality above ground. The soil remedy will also remove soil contaminated with non-VOCs from accessible areas to be protective of ongoing and future site uses. Restrictions on future land use, including residential, hospital, day care center and school uses, will be implemented for Cooper Drum with the understanding that excavation of all non-VOC contaminated soil beneath existing structures is deemed infeasible. Land use restrictions could be lifted if the contaminated soil beneath structures is removed or treated prior to future land development.

Cooper Drum is located in a dense urban land use setting of mixed residential, commercial, and industrial parcels. The surrounding land uses are anticipated to continue to be of mixed urban uses. The ongoing drum processing operations at Cooper Drum are considered to be a heavy industrial use for which the property is currently zoned. The City of South Gate Community Development Department is currently reevaluating land use designations and development options for the next 10 to 15 years. New zoning restrictions may be enacted to conform with any changes made to land use designations.

Future reasonably anticipated land use options for Cooper Drum include light industrial and high density commercial. Current drum processing operations could continue under a "grandfather rule" which allows for non-conforming status as long as operations are not expanded. Due to the proximity to the area where a regional high speed rail corridor may be built, it is also possible that future development for residential housing could be considered for Cooper Drum. Residential use could occur only after the selected remedy for soil is completed and residual non-VOC contamination above action levels is removed from beneath structures.

The contaminated groundwater under Cooper Drum is semi-confined in the upper aquifer and characterized as shallow groundwater of poor quality water (e.g. due to high background levels of arsenic, sulfate, chloride and total dissolved solids). Although the upper aquifer is not currently used as a drinking water source, Cooper Drum is located within a groundwater basin (the Central Basin) that is designated by the Water Quality Control Plan for the Los Angeles Region (the Basin Plan) as having beneficial uses for drinking water, agricultural, industrial processes, and industrial services. There are no other potential beneficial uses associated with groundwater in the upper aquifer underlying Cooper Drum. The potential for on-site residential land use, which includes groundwater at Cooper Drum being used as a drinking water source, is the most conservative scenario used as a basis for the reasonable exposure assessment assumptions and risk characterization conclusions that prompted the remedial action objectives for Cooper Drum. Once implemented, the selected remedy for groundwater will protect the existing beneficial uses of the currently uncontaminated deeper aquifers (starting with the Exposition Aquifer) and will remove VOC contamination above drinking water standards in the upper (shallow) aquifer.

Cleanup Levels for Soil and Groundwater

The cleanup levels for contaminated soil and groundwater for Cooper Drum are listed in Table 12-5.

Soil VOCs

The cleanup levels for VOCs in soil are to be determined (TBD) based on the remedial goal, which is to prevent the vertical migration of leachate at concentrations that would impact the shallow aquifer above drinking water standards (MCLs). To evaluate attainment of this goal, performance evaluation soil gas samples will be collected during remediation (soil vapor extraction). The sampling results will then be used in the VLEACH model to evaluate impact to groundwater. The soil gas sample analytical results will also be input into the Johnson & Ettinger Model (which estimates indoor air concentration) to ensure that residual VOC concentrations remaining in soil (after soil vapor extraction) are protective of potential indoor air receptors.

Soil Non-VOCs

The polycyclic aromatic hydrocarbon (PAH) cleanup level for soil is based on the upper tolerance limit (UTL) background Benzo(a)pyrene-toxicity equivalent (B(a)P-TE) concentration for the southern California PAH data set which is 900 µg/kg B(a)P-TE. The detected PAH concentrations in each confirmation sample will be multiplied by the applicable toxicity equivalency factors (TEF) and summed to generate a B(a)P-TE value. The B(a)P-Te will be calculated using TEF values recommended by DTSC (as noted in parentheses) for each of the following PAHs:

- Benzo(a) anthracene (0.1)
- Benzo(a)pyrene (1.0)
- Benzo(b) fluoranthene (0.1)
- Benzo(k) fluoranthene (0.1)
- Chrysene (0.01)
- Dibenz(a,h)anthracene (0.34)
- Indeno(1,2,3-cd) pyrene (0.1)

The PCB cleanup goal of 870 µg/kg for soil was back-calculated by applying the same residential exposure parameters used in the site HHRA for Cooper Drum (See Appendix L, Cooper Drum RI/FS Report, URS, 2002) and a target health risk level of 1 in 100,000 (1.0e-05).

The lead cleanup goal of 400 ppm is based on the Integrated Exposure Uptake Biokinetic Model for Lead in Children (IEUBK) for residential use.

Groundwater VOCs

The cleanup levels for VOCs in groundwater are the California primary drinking water standards (MCLs). Since no MCL has been established for 1,2,3-TCP, the practical quantitation limit (PQL) will be used.

Table 12-5 Cleanup Levels for Contaminants of Concern				
Medium	**Contaminant of Concern**	**Cleanup Level**	**Basis for Clean up Level**	**Risk at Cleanup Level**
Soil (VOCs)	1,1-Dichloroethane (1,1-DCA)	Leachate <MCL[a]	VLEACH modeling	TBD
	1,1-Dichloroethene (1,1-DCE)	Leachate <MCL	VLEACH modeling	TBD
	1,2-Dichloroethane (1,2-DCA)	Leachate <MCL	VLEACH modeling	TBD
	1,2-Dichloropropane (1,2-DCP)	Leachate <MCL	VLEACH modeling	TBD
	1,2,3-Trichloropropane (1,2,3-TCP)	Leachate <PQL	VLEACH modeling	TBD
	Benzene	Leachate <MCL	VLEACH modeling	TBD
	cis-1,2-Dichloroethene (cis-1,2-DCE)	Leachate <MCL	VLEACH modeling	TBD
	trans-1,2-Dichloroethene (trans-1,2-DCE)	Leachate <MCL	VLEACH modeling	TBD
	Tetrachloroethene (PCE)	Leachate <MCL	VLEACH modeling	TBD
	Trichloroethene (TCE)	Leachate <MCL	VLEACH modeling	TBD
	Vinyl chloride	Leachate <MCL	VLEACH modeling	TBD
Soil (nonVOCs)	Aroclor-1254	870 µg/kg	Human health hazard	1 e-05
	Aroclor-1260	870 µg/kg	Human health hazard	1 e-05
	B (a)P-TE [b] - Benzo(a)anthracene - Benzo(a)pyrene - Benzo(b)fluoranthene - Benzo(k)fluoranthene - Chrysene - Dibenz(a,h)anthracene - Indeno(1,2,3-cd)pyrene	900 µg/kg	Background	Background
	Lead	400 mg/kg	Human health hazard	IEUBK Model
Groundwater (VOCs)	1,1-Dichloroethane (1,1-DCA)	5 µg/L	MCL	Cancer risk at 2.6e-06
	1,1-Dichloroethene (1,1-DCE)	6 µg/L	MCL	HI = 0.04
	1,2-Dichloroethane (1,2-DCA)	0.5 µg/L	MCL	Cancer risk at 4.0e-06
	1,2-Dichloropropane (1,2-DCP)	5 µg/L	MCL	Cancer risk at 3.1e-05
	1,2,3-Trichloropropane (1,2,3-TCP)	1 µg/L	PQL [c]	Cancer risk at 6.2e-04
	Benzene	1 µg/L	MCL	Cancer risk at 9.0e-06
	cis-1,2-Dichloroethene (cis-1,2-DCE)	6 µg/L	MCL	HI = 0.23
	trans-1,2-Dichloroethene (trans-1,2-DCE)	10 µg/L	MCL	HI = 0.19
	Tetrachloroethene (PCE)	5 µg/L	MCL	Cancer risk at 1.2e-05
	Trichloroethene (TCE)	5 µg/L	MCL	Cancer risk at 4.9e-06
	Vinyl chloride	0.5 µg/L	MCL	Cancer risk at 2.2e-05

µg/L micrograms per liter
µg/kg micrograms per kilogram
MCL California primary maximum contaminant level
PQL Practical quantification limit
TBD To be determined
IEUBK Model - Integrated Exposure Uptake Model for Lead in Children

[a] MCLs from Title 22 California Code of Regulation Section 64431 and 64444 unless otherwise specified.
[b] Based on upper tolerance limit (UTL) background Benzo(a)pyrene-toxicity equivalent (B(a)P-TE) concentration for southern California PAH data set.
[c] No MCL established for 1,2,3-trichloropropane. The PQL was identified as a remedial goal for 1,2,3-trichloropropane.

13.0 Statutory Determination

Under CERCLA §121 and the NCP, the lead agency must select remedies that are protective of human health and the environment, comply with applicable or relevant and appropriate requirements (unless a statutory waiver is justified), are cost-effective, and utilize permanent solutions and alternative treatment technologies or resource recovery technologies to the maximum extent practicable. In addition, CERCLA includes a preference for remedies that employ treatment that permanently and significantly reduces the volume, toxicity, or mobility of hazardous wastes as a principal element and a bias against off-site disposal of untreated wastes.

13.1 Protection of the Human Health and the Environment

The selected remedy, soil Alternative 3, will protect human health and the environment through the treatment of VOC-contaminated soil by using an enhanced soil vapor extraction system (DPE treatment system) and excavation and off-site disposal of non-VOC contaminated soil. Treatment of VOC soil contaminants eliminates the potential for migration to groundwater and the threat of indirect on-site and off-site exposures via ingestion of contaminated groundwater. The selected remedy for VOCs in soil will reduce contamination so that the groundwater will meet the protective state and federal drinking water standards.

Removal of non-VOC contaminants in the soil eliminates the threat of exposure via ingestion and dermal contact by on-site human receptors. The cumulative excess carcinogenic risk from non-VOC exposure is estimated at 3.3e-04 with a non-carcinogenic HI of 3. The risks from non-VOC soil exposure will be reduced to within the EPA's target carcinogenic risk range of 10e-04 to 10e-06 and the noncarcinogenic risk (HI) to less than 1.0.

A pump-and-treat system enhanced with chemical in situ treatment will restore the contaminated aquifer for potential beneficial use as a drinking water source and prevent the existing plume from migration to deeper aquifers used as a regional drinking water source. Treatment of groundwater will eliminate the threat of exposure via ingestion and inhalation of contaminated water by on-site and off-site human receptors. The cumulative excess carcinogenic risk from exposure to groundwater contaminants is estimated at 3.3e-02 with an non-carcinogenic HI of 193. The selected remedy for groundwater will reduce contamination to meet the protective state and federal drinking water standards.

13.2 Compliance with Applicable or Relevant and Appropriate Requirements

Remedial actions selected under CERCLA must comply with ARARs under federal environmental laws or, where more stringent than the federal requirements, state environmental or facility siting laws. Where a State has been delegated authority to enforce a federal statute, such as RCRA, the delegated portions of the statute are considered to be a federal ARAR unless the state law is broader or more stringent than the federal law.

The ARARs are identified on a site-specific basis from information about site-specific chemicals, specific actions that are being considered, and specific site location features. There are three categories of ARARs: 1) chemical-specific requirements, 2) location-specific requirements, and 3) action specific requirements. Where there are no chemical-, location-, or action-specific ARARs, EPA may consider non-promulgated federal or state advisories and guidance as to-be-considered (TBC) criteria. Although consideration of a TBC criteria is not required, standards based on TBCs are legally enforceable as performance standards.

Chemical-specific ARARs are risk-based standards or methodologies that may be applied to site-specific conditions and result in the development of cleanup levels for the COCs at Cooper Drum.

Location-specific ARARs are restrictions placed on the chemical contaminant or the remedial activities based on a geographic or ecological features. Examples of features include wetlands, floodplains, sensitive ecosystems and seismic areas.

Action-specific ARARs are usually technology- or activity-based requirements. They are triggered by the particular remedial activities selected to accomplish a remedy.

A summary of ARARs and TBC criteria for the selected remedy are presented in Table 13-1.

Table 13-1
ARARs for Selected Remedy

Authority	Medium	Legal Authority	Status	Synopsis of Requirement	Actions to be Taken to Attain Requirement
CHEMICAL-SPECIFIC ARARs					
Federal Regulatory Authority	Groundwater	Federal Primary Drinking Water Standards 40 CFR Part 141	Relevant and appropriate	Federal drinking water standards protect the public from contaminants that may be found in drinking water. The groundwater underlying Cooper Drum is a potential source of drinking water.	The selected remedy will use federal MCLs, unless State MCLs are more stringent, as cleanup levels for VOCs in groundwater and to protect groundwater from soil contaminants.
State Regulatory Authority	Groundwater	California Primary Drinking Water Standards H&S Code §4010 et seq. 22 CCR §64431 and 64444	Relevant and appropriate	California drinking water standards protect public health from contaminants found in drinking water sources. The groundwater underlying Cooper Drum is a potential source of drinking water.	The selected remedy will use state MCLs more stringent than federal MCLs as cleanup levels for VOCs in groundwater and to protect groundwater from soil contaminants.
State Regulatory Authority	Groundwater	Basin Plan for Los Angeles Region California Water Code §13240 et seq.	Relevant and appropriate	Establishes beneficial uses of ground and surface waters, establishes water quality objectives, including narrative and numerical standards, establishes implementation plans to meet water quality objectives and protect beneficial uses, and incorporates statewide water quality control plans and policies. The WQOs for groundwater are based on the primary MCLs.	The selected remedy will use the most stringent state or federal MCLs as cleanup levels for VOCs in groundwater and to protect groundwater from soil contaminants.
State Regulatory Authority	Groundwater	SWRCB Resolution No. 92-49 Policy and Procedures for Investigation and Cleanup and Abatement of Discharges under California Water Code §13304 (amended 4\21\94) California Water Code §13307 23 CCR §2550.4	Relevant and appropriate	To protect groundwater, the resolution requires cleanup to either background water quality or the best water quality that is reasonable if background water quality cannot be restored. Non-background cleanup levels must be consistent with maximum benefit to the public, present and anticipated future beneficial uses, and conform to water quality control plans and policies.	Groundwater at Cooper Drum will be cleaned up to MCLs for VOCs or to attain the best water quality that is reasonable, e.g. 1 ppb for 1,2,3-TCP which is the chemical detection limit.

Table 13-1 ARARs for Selected Remedy					
Authority	**Medium**	**Legal Authority**	**Status**	**Synopsis of Requirement**	**Actions to be Taken to Attain Requirement**
LOCATION-SPECIFIC ARARS					
State Regulatory Authority	Soil and groundwater	Prohibition-Destruction of Bird Eggs and Nests Fish & Game Code §3503	Applicable	This law prohibits take, possession, or needless destruction of any bird nests and eggs, except as provided by the Fish and Game Code or regulations.	Project construction of the selected remedy will not result in a 'take' and will comply with this requirement.
State Regulatory Authority	Soil and groundwater	Non-Game Animals Fish & Game regulations 14 CCR §472	Applicable	Regulation provides that nongame birds and mammals may not be taken except for English sparrow, starling, coyote, weasels, skunks, opossum, moles, and rodents (excludes tree and flying squirrels, and those listed as furbearers, endangered, or threatened species); and American crows.	Project construction of the selected remedy will not result in a 'take' and will comply with this requirement.
ACTION-SPECIFIC ARARS					
Federal Regulatory Authority	Groundwater	NPDES Non-Point Source Discharge 40 CFR §122.26	Relevant and appropriate	Nonpoint sources address using best management practices for control of contaminants to stormwater run-off from construction activities on sites greater than 1 acre.	Since alternatives that evaluate soil excavation are confined to less than 1 acre, the requirement is not applicable but is relevant and appropriate. BMPs will be established to prevent stormwater run-off.
State Regulatory Authority	Groundwater	Basin Plan for Los Angeles Region Chapter 4 - Remediation of Pollution	Relevant and appropriate	The Basin Plan recognizes the cleanup goals based on the State's Antidegradation Policy as set forth in State Board Resolution No. 68-16. Under the Antidegradation Policy, whenever the existing quality of water is better than that needed to protect present and potential beneficial uses, such existing quality will be maintained.	Antidegradation requirements obligates EPA to prevent further degradation of the water during and at completion of the cleanup action for reinjection of treated groundwater to the aquifer and chemical injection to the aquifer to facilitate reductive dechlorination and oxidation. Any reinjection or chemical injection will be conducted in the plume to prevent further degradation where possible. The selected remedy will comply with the substantive RWQCB waste discharge requirements (WDRs) for chemical injection and reinjection.

Table 13-1 ARARs for Selected Remedy					
Authority	**Medium**	**Legal Authority**	**Status**	**Synopsis of Requirement**	**Actions to be Taken to Attain Requirement**
State Regulatory Authority	Groundwater	Water Quality Control Plan (Basin Plan) for Los Angeles Region (adopted 9\09\00) California Water Code §13240 et seq.	Relevant and appropriate	Presents numerical and narrative water quality objectives for maintaining a high quality of protection for the inland surface water and groundwater in the region. Groundwater underlying Cooper Drum has been identified by the Basin Plan as a potential drinking water aquifer.	Relevant to treated groundwater re-injection to the aquifer and soil cleanup to protect groundwater quality. Reinjection of treated VOC-contaminated groundwater will meet State and Federal MCLs. Soil VOC cleanup levels based on protection of groundwater quality for drinking water.
State Regulatory Authority	Groundwater	Non-Degradation Policy SWRCB Resolution No. 68-16 Water Code §13140	Applicable	Requires maintaining the existing water quality using best practicable treatment technology unless a demonstrated change will benefit the people of California, will not unreasonably affect present or potential uses, and will not result in water quality less than that prescribed in other state policies. Determination is made through a two-step process to determine (1) whether further degradation may be allowed, and (2) the discharge level which will result in the best practicable treatment or control of the discharge.	Antidegradation requirements will be addressed to prevent further degradation of the water during and at completion of the cleanup action. for reinjection of treated groundwater. Any reinjection or chemical injection will be conducted in the plume to prevent further degradation where possible. The selected remedy will comply with the substantive RWQCB WDRs for chemical injection and reinjection.
State Regulatory Authority	Soil	California Water Code §13140 - 13147, 13172, 13260, 13263, 132267, 13304 27 CCR Div.2, Subdiv.1, Chap.3, Subchap.2, Art.2	Applicable	Wastes classified as a threat to water quality (designated waste) may be discharged to a Class I hazardous waste or Class II designated waste management unit. Nonhazardous solid waste may be discharged to a Class I, II, or III waste management unit. Inert waste would not be required to be discharged into a SWRCB-classified waste management unit.	Waste will be classified for disposal to appropriate permitted off-site waste management units. CERCLA waste (e.g., contaminated soil, IDW, spent GAC) would be disposed at a off-site disposal facility.
State Regulatory Authority	Groundwater	Sources of Drinking Water SWRCB Resolution No. 88-63	Applicable	This policy specifies that ground and surface waters of the state are either existing or potential sources of municipal and domestic supply.	The requirement establishes groundwater underlying Cooper Drum as a potential source for drinking water. The selected remedy will apply a groundwater cleanup level protective of drinking water.

Table 13-1
ARARs for Selected Remedy

Authority	Medium	Legal Authority	Status	Synopsis of Requirement	Actions to be Taken to Attain Requirement
State Regulatory Authority	Soil and groundwater	Hazardous waste regulations Identification and Listing of Hazardous Waste 22 CCR Div. 4.5, Chap. 11 22 CCR §66264.13 22 CCR §66260.200	Applicable	A generator must determine if the waste is classified as a hazardous waste in accordance with the criteria provided in these requirements.	The selected remedy will comply with the waste classification requirements to determine proper disposal of waste. Waste characteristics of treated soil and groundwater will be defined prior to treatment and disposal.
State Regulatory Authority	Soil and groundwater	Hazardous waste regulations Standards Applicable to Generators of Hazardous Waste 22 CCR Div. 4.5, Chap. 12	Relevant and appropriate	Establishes waste storage timeframes on site. The purpose of the 90-day storage limit is to prevent creating a greater environmental hazard than already exists at Cooper Drum.	Waste contained on site will be maintained in a container in good conditions prior to off-site disposal.
State Regulatory Authority	Soil and groundwater	Hazardous waste regulations Hazardous Waste Security 22 CCR §66264.14	Relevant and appropriate	A treatment facility should maintain a fence in good repair which completely surrounds the active portion of the facility. A locked gate at the facility should restrict unauthorized personnel entrance. The security standards to prevent entry from unauthorized personnel for the proposed remedial treatment alternatives should be applied.	The selected remedy will comply with the security requirements around the treatment plant.

Table 13-1 ARARs for Selected Remedy					
Authority	**Medium**	**Legal Authority**	**Status**	**Synopsis of Requirement**	**Actions to be Taken to Attain Requirement**
State Regulatory Authority	Soil and groundwater	Hazardous waste regulations Hazardous Waste Facility General Inspection Requirements and Personnel Training 22 CCR §66264.15 - 66264.16	Relevant and appropriate	The hazardous waste facility standards require routine facility inspections conducted by trained hazardous waste facility personnel. Inspections are to be conducted at a frequency to detect malfunctions and deterioration, operator errors, and discharges which may be causing or leading to a hazardous waste release and a threat to human health or the environment.	The treatment system will comply with this requirement and provide treatment system inspections for malfunctions and deterioration.
State Regulatory Authority	Soil and groundwater	Hazardous waste regulations Preparedness and Prevention 22 CCR Div. 4.5, Chap. 14, Art. 3	Relevant and appropriate	Facility design and operation to minimize potential fire, explosion, or unauthorized release of hazardous waste.	The selected remedy will comply with the design requirements.
State Regulatory Authority	Groundwater	Hazardous waste regulations Water Quality Monitoring and Response Systems for Permitted Systems 22 CCR Div. 4.5, Chap. 14, Art. 6	Relevant and appropriate	The requirements present the groundwater monitoring system objectives and standards to evaluate the effectiveness of the corrective action program (remedial activities). After completion of the remedial activities and closure of the facility, groundwater monitoring will continue for an additional three years to ensure attainment of the remedial action objectives.	The selected remedy will comply with these requirements by monitoring to demonstrate all the COCs concentrations are reduced to levels below cleanup levels.
State Regulatory Authority	Soil and groundwater	Hazardous waste regulations Closure and Post-Closure 22 CCR Div. 4.5, Chap. 14, Art. 7	Relevant and appropriate	The closure and post-closure requirements establish standards to minimize maintenance after facility closure to protect human health and the environment. The closure and post-closure requirements may be dependent upon the treatment alternatives.	The selected remedy will comply with these requirements. Specific closure conditions of the treatment facilities will be provided in a site closure report after completion of the remedial action.

Table 13-1 ARARs for Selected Remedy					
Authority	**Medium**	**Legal Authority**	**Status**	**Synopsis of Requirement**	**Actions to be Taken to Attain Requirement**
State Regulatory Authority	Soil and groundwater	Hazardous waste regulations Use and Management of Containers 22 CCR Div. 4.5, Chap. 14, Art. 9	Relevant and appropriate	Maintain container and dispose to a Class I hazardous waste disposal facility within 90 days. The 90-day storage limit prevents greater environmental hazard than already exists. Maintaining the containers in good conditions at all times and not creating an environmental hazard is relevant and appropriate.	Storage of investigation-derived waste (i.e., soil cuttings from well development) will occur. Requirements may apply for the storage of contaminated groundwater and sediments trapped by the bag filter during start-up operation. Waste contained on site will be maintained in a container in good condition prior to off-site disposal.
State Regulatory Authority	Groundwater	Hazardous waste regulations Tank Systems 22 CCR Div. 4.5, Chap. 14, Art. 10	Relevant and appropriate	Minimum design standards (i.e., shell strength, foundation, structural support, pressure controls, seismic considerations) for tank and ancillary equipment are established. The requirements for minimum shell thickness and pressure controls to prevent collapse or rupture prevents a greater environmental hazard than already exists.	The selected remedy will comply and treatment system design requirements not to create an environmental hazard greater than already exists.
State Regulatory Authority	Soil and groundwater	Hazardous waste regulations Miscellaneous Units 22 CCR Div. 4.5, Chap. 14, Art. 16 22 CCR §66264.601 - 66264.603	Relevant and appropriate	Minimum performance standards are established for miscellaneous equipment to protect health and the environment. "Miscellaneous unit" are units that are not a container, tank, surface impoundment, pile, land treatment unit, landfill, incinerator, boiler, industrial furnace other than industrial furnaces (i.e., injection wells, treatment system).	None of the COCs are classified as hazardous waste. The selected remedy will comply with those environmental performance standards to protect human health and the environment in the treatment system design and construction.
State Regulatory Authority	Air	South Coast Air Quality Management District (SCAQMD) Rules and Regulations Regulation IV, Rule 402, Nuisance.	Applicable	A person shall not discharge from any source whatsoever such quantities of air contaminants or other material which cause injury, detriment, nuisance, or annoyance to any considerable number of persons or to the public or which endanger the comfort, repose, health, or safety of any such persons or the public or which cause to have a natural tendency to cause injury or damage to business or property.	The selected remedy will provide short- and long-term emission control measures during construction and O&M to prevent impacts to the public.

Table 13-1 ARARs for Selected Remedy					
Authority	**Medium**	**Legal Authority**	**Status**	**Synopsis of Requirement**	**Actions to be Taken to Attain Requirement**
State Regulatory Authority	Air	South Coast Air Quality Management District (SCAQMD) Rules and Regulations Regulation IV, Rule 403, Fugitive Dust	Applicable	Emissions of fugitive dust shall not remain visible in the atmosphere beyond the property line of the emission source. Activities conducted in the South Coast Air Basin shall use best available control measures to minimize fugitive dust emissions and take necessary steps to prevent the track-out of bulk material onto public paved roadways as a result of their operations.	The selected remedy will provide short- and long-term fugitive emission control measures during construction and O&M to prevent impacts to the public
State Regulatory Authority	Air	South Coast Air Quality Management District (SCAQMD) Rules and Regulations Regulation IV, Rule 404, Particulate Matter – Concentration.	Applicable	Particulate matter in excess of the concentration standard conditions shall not be discharged from any source. Particulate matter in excess of 450 milligrams per cubic meter (0.196 grain per cubic foot) in discharged gas, calculated as dry gas at standard conditions, shall not be discharged to the atmosphere from any source.	The selected remedy will provide emission control measures during construction and O&M to comply with these emission standards.
State Regulatory Authority	Air	South Coast Air Quality Management District (SCAQMD) Rules and Regulations Regulation IV, Rule 405, Solid Particulate Matter – Weight.	Applicable	Solid particulate matter including lead and lead compounds discharged into the atmosphere from any source shall not exceed the rates Table 450(a) of Rule 405. Nor shall solid particulate matter including lead and lead compounds in excess of 0.23 kilogram (0.5 pound) per 907 kilograms (2,000 pounds) of process weight be discharged to the atmosphere. Emissions shall be averaged over one complete cycle of operation or one hour, whichever is the lesser time period.	The selected remedy will provide emission control measures during excavation of lead contaminated soil to comply with these emission standards.

Table 13-1
ARARs for Selected Remedy

Authority	Medium	Legal Authority	Status	Synopsis of Requirement	Actions to be Taken to Attain Requirement
State Regulatory Authority	Air	South Coast Air Quality Management District (SCAQMD) Rules and Regulations Regulation XIII, Rule 1303 - New Source Review	Applicable	Construction for any relocation or for any new or modified source which results in an emission increase of any nonattainment air contaminant, any ozone-depleting compound, or ammonia, must include BACT for the new or relocated source or for the actual modification to an existing source. This requirement would apply to treatment technologies with potential to emit primary pollutant(s) to the atmosphere.	The selected remedy will be designed and constructed with BACT emission control measures on the treatment system to comply with these emission standards.
State Regulatory Authority	Air	South Coast Air Quality Management District (SCAQMD) Rules and Regulations Regulation XIV, Rule 1401, New Source of Toxic Air Contaminants.	Applicable	Construction or reconstruction of a major stationary source emitting hazardous air pollutants shall be constructed with Best Available Control Technology for Toxics (T-BACT) and complies with all other applicable requirements.	The selected remedy will be designed and constructed to comply with T-BACT emission standards.
TO-BE-CONSIDERED CRITERIA					
TBC	Soil and groundwater	California Well Standards California Department of Water Resources Bulletin 74-90	To-be-considered	Provides minimum specifications for monitoring wells, extractions wells, injection wells, and exploratory borings. Design and construction specifications are considered for construction and destruction of wells and borings.	Extraction and injection well siting requirements are inappropriate for Cooper Drum because the effectiveness of the remedy is dependent upon well locations. Wells constructed for the selected remedy (e.g., extraction wells, injection wells, monitoring well, soil vapor wells) will be constructed to meet the minimum state standards.

13.3 Cost Effectiveness

In EPA's judgement, the selected remedies for soil and groundwater are cost-effective and present reasonable value. According to the NCP, a remedy is cost-effective if its costs are proportional to its overall effectiveness. The overall effectiveness of the selected remedies for soil and groundwater was demonstrated in the comparative analysis of the alternatives. The selected remedies satisfy the threshold criteria (overall protectiveness and compliance with ARARs), while scoring highly with respect to the three balancing criteria of long-term effectiveness, reduction in toxicity, mobility, and volume through treatment, and short-term effectiveness.

The overall effectiveness of the alternatives was then evaluated with respect to the respective cost estimates. Because the selected remedies for soil and groundwater provide effective and permanent solutions in a relatively short time-frame, the overall cost of implementation may be higher or lower relative to less effective alternatives.

The selected remedy for soil (Alternative 3) includes an excavation component for removal of non-VOCs in accessible areas. This is in addition to use of institutional controls which is also included in soil Alternative 2. Excavation and off-site disposal of contaminated soil reduces the volume of contamination and provides an effective and permanent remedy in a short time-frame. Implementation of institutional controls alone does not reduce the volume of contamination. Therefore, in EPA's judgement, the added cost of excavation is justified in order to effectively satisfy the threshold and balancing CERCLA criteria.

The selected remedy for groundwater (Alternative 4) includes possible use of an in situ technology combined with extraction and treatment. It is expected that use of in situ oxidation and/or reductive dechlorination will enhance destruction of VOCs in the aquifer over the short-term. When compared to use of pump-and-treat alone, addition of in situ treatment may actually result in cost savings because of the expected reduction in time, as well as the lower amount/intensity of extraction and treatment required to reach remedial action goals. For cost estimating purposes, however, no reduction in remedial action time or effort was assumed. This led to higher projected capital costs for the selected remedy as compared to pump-and-treat alone (Alternative 2). Because of the reduced extraction volume, the projected annual O&M costs were actually lower for the selected remedy. Provided the results of planned pilot-scale tests are positive, the EPA believes that use of an in situ technology in addition to pump-and-treat is more cost-effective than use of stand-alone pump-and-treat, or conversely, use of stand-alone in situ treatment (as in Alternative 6).

13.4 Utilization of Permanent Solutions and Alternative Treatment Technologies to the Maximum Extent Practicable

The EPA believes that the selected remedies for soil and groundwater represent the maximum extent to which permanent and alternative solutions can be used in a practical manner at Cooper Drum. As shown in Table 10-1, the selected remedies for soil and groundwater satisfy the threshold criteria of overall protection and compliance with ARARs, while scoring competitively with respect to the five balancing CERCLA criteria. An evaluation of the selected remedies with respect to the balancing and modifying criteria follows.

Selected Remedy for Soil (Alternative 3)

Long-term Effectiveness and Permanence: The selected remedy includes the use of dual phase extraction (DPE), an enhancement of soil vapor extraction (SVE), which is the presumptive remedy for VOCs in soil. With respect to non-VOCs, the selected remedy combines the use of excavation in accessible areas, and institutional controls in non-accessible soil areas. In comparison, Alternative 2 relies only on institutional controls.

Reduction of Toxicity, Mobility, or Volume Through Treatment: Use of extraction/DPE will permanently and effectively reduce the volume of VOC contamination in soil. Because of the mix of non-VOC contaminants, use of individual treatment methods for each component is not feasible. Excavation and off-site disposal of contaminated soil will reduce the volume of contamination in accessible soil areas. Institutional controls alone, as in Alternative 2, would only reduce mobility of non-VOCs so long as the pavement is maintained.

Short-term Effectiveness: The extraction/DPE action is expected to be completed within two years. Compared to Alternative 2, excavation and disposal of contaminated soil is expected to expedite short-term effectiveness. Appropriate health and safety measures must be adhered to during the remedial action.

Implementability: The selected remedy is technically feasible and implementable. All material and equipment is commercially available. Implementation of institutional controls will require the cooperation of the state (DTSC) and/or local government. The excavation component of the selected remedy will be readily implementable, except beneath existing structures.

Costs: The selected remedy is cost-effective.

State Acceptance: The DTSC and RWQCB have accepted the selected remedy.

Community Acceptance: The community has accepted the selected remedy.

Selected Remedy for Groundwater (Alternative 4)

Long-term Effectiveness and Permanence: The selected remedy is expected to be highly effective and permanent because it combines the use of a proven and effective ex situ technology (extraction/GAC treatment) with the use of an alternative in situ technology (chemical oxidation and/or reductive dechlorination). Pilot-scale tests are planned to ensure the effectiveness of, and aid in the design of, the in situ response action prior to full-scale implementation.

Reduction of Toxicity, Mobility, or Volume Through Treatment: The volume of contamination will be reduced through active treatment. The combination of treatments is expected to be more effective than use of either ex situ or in situ treatment alone.

Short-term Effectiveness: By including an in situ treatment component, the EPA expects to expedite the completion of remedial action. Use of lower extraction rates will reduce the potential for commingling with off-site plumes but will be sufficient for plume containment. Lower VOC concentrations may be observed shortly after in situ treatment. Appropriate health and safety measures must be adhered to during the remedial action, especially when handling any oxidizing agents.

Implementability: The selected remedy is technically feasible and implementable. All material and equipment is commercially available. The EPA believes that the added implementation effort associated with in situ treatment is justified in view of the possible cost savings and increased effectiveness over the short and long term.

Costs: The selected remedy is cost-effective. The added capital cost of in situ treatment is expected to be compensated by lower annual O&M costs and shorter duration of remedial action.

State Acceptance: The DTSC and RWQCB have accepted the selected remedy.

Community Acceptance: The community has accepted the selected remedy.

13.5 Preference for Treatment as a Principal Element

There is no source material(s) posing a principal threat at Cooper Drum and EPA's statutory preference for treatment of principal threats does not apply to this site (NCP §300.430(a)(1)(iii)(A)).

However, this remedy satisfies the statutory preference for treatment as a principal element of the remedy (i.e., reduces the toxicity, mobility, or volume of hazardous substances, pollutants, or contaminants as a principal element through treatment) (NCP §300.430(f)(5)(ii)(F)). Treatment is a major component of the selected remedy for soil and groundwater. The VOC soil contaminants are a potential threat to groundwater and will be treated using DPE technology. A relatively low concentration groundwater contaminant plume will use a pump-and-treat system using GAC and chemical in situ treatment.

13.6 Five-Year Review Requirements

Because this remedy may result in hazardous substances, pollutants, or contaminants remaining on site above levels that allow for unlimited use and unrestricted exposure, and will take longer than five years to attain RAOs and cleanup levels, a policy review will be conducted within five years of construction completion for Cooper Drum to ensure that the remedy is, or will be, protective of human health and the environment.

14.0 Documentation of Significant Changes

The Proposed Plan for Cooper Drum was released for public comment in June 2002. The Proposed Plan identified soil Alternative 3 - dual phase extraction and treatment, institutional control, and excavation as the Preferred Alternative for soil remediation. Groundwater Alternative 4 - extraction and treatment with in situ chemical treatment consisting of reductive dechlorination and chemical oxidation was identified as the Preferred Alternative for groundwater remediation. EPA reviewed all written and verbal comments submitted during the public comment period. It was determined that no significant changes to the remedy, as originally identified in the Proposed Plan, were necessary or appropriate.

PART III RESPONSIVENESS SUMMARY

1.0 Stakeholder Issues and EPA Responses

After review of the Cooper Drum RI/FS Report (URS, 2002b), the DTSC raised concern regarding data gaps which have not been sufficiently defined: 1) the lateral and vertical extent of VOCs in the vadose zone beneath the drum processing building; 2) the lateral and vertical extent of non-VOCs (PCBs, PAHs, Dieldrin, and Lead) in the soil beneath the HWA and DPA; and 3) the lateral and vertical extent of VOCs in the downgradient area (beyond the Cooper Drum boundary) of the groundwater plume. The DTSC has agreed to the selected soil and groundwater remedies providing additional data is collected to address its concerns prior to implementation of the selected remedy.

During the public comment period for the Proposed Plan, no written comments were received. Questions that were raised at the Public Meeting were addressed by EPA staff. There were no significant issues or objections directed toward the selected remedy. EPA believes that the selected remedy addresses the community concerns that were identified during community interviews. The main concern was that the selected remedy should not include incineration of contaminants, which could further impact air quality conditions. The selected remedies for soil and groundwater do not include incineration of contaminants and will not adversely impact air quality; therefore, community concerns have been addressed.

2.0 Technical and Legal Issues

2.1 Technical Issues

The EPA has included the following components in the selected soil and groundwater remedy to address the DTSC concerns.

Conduct additional soil gas sampling in the drum processing area (DPA) during the remedial design (RD) phase to further identify the extent of VOC contamination and the need for remediation using dual phase extraction in this area.

Conduct additional soil sampling in the DPA and HWA during the RD phase to further define the extent of non-VOC contamination and the need for remediation beyond the estimated 2,700 tons of soil.

Conduct additional groundwater sampling during the RD phase to further define the downgradient extent of the VOC contamination (beyond the property boundary).

2.2 Legal Issues

None identified.

ATTACHMENT 4

TO UNILATERAL ADMINISTRATIVE ORDER 2009-07
IN THE MATTER OF A.G. LAYNE, INC., ET. AL.

REMEDIAL DESIGN REPORTS
OU1 GROUNDWATER AND OU2 SOIL

(Text of Volume 1)

Access to complete reports is available online at:
http://yosemite.epa.gov/r9/sfund/r9sfdocw.nsf/vwsoalphabetic/Cooper+Drum+Co.?OpenDocument

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GROUNDWATER REMEDIAL DESIGN REPORT
OPERABLE UNIT 1
COOPER DRUM COMPANY SUPERFUND SITE

Prepared for:

Contract No. 68-W-98-225/WA No. 247-RDRD-091N
U.S. Environmental Protection Agency, Region 9
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September 19, 2007

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ACRONYMS AND ABBREVIATIONS

AOC	Administrative Order on Consent
AOP	advanced oxidation process
ARARs	applicable or relevant and appropriate requirements
bgs	below ground surface
COC	contaminant of concern
CPT	cone penetrometer test
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CPVC	chlorinated polyvinyl chloride
CQCP	Construction Quality Control Plan
DCA	dichloroethane
DCE	dichloroethene
DCP	dichloropropane
DEW	downgradient extraction well
DHS	Department of Health Services
DO	dissolved oxygen
DPA	Drum Processing Area
DPE	dual-phase extraction
DTSC	California Department of Toxic Substances Control
EH&S	environmental health and safety
EPA	United States Environmental Protection Agency
EW	extraction well
GAC	granular activated carbon
gpm	gallons per minute
H_2O_2	hydrogen peroxide
HASP	Health and Safety Plan
HDPE	high density polyethylene
HRA	health risk assessment
HRC	Hydrogen Release Compound
H&S	health and safety
HWA	Hard Wash Area
ISCO	in situ chemical oxidation
LEL	lower explosive limit
LACDHS	Los Angeles County Department of Health Services
LACSD	Los Angeles County Sanitary District
LGAC	liquid-phase granular activated carbon

ACRONYMS AND ABBREVIATIONS (CONTINUED)

MCL	California maximum contaminant level
mg/L	milligrams per liter
mV	millivolts
MW	monitoring well
NAPL	non-aqueous phase liquids
NCP	Natural Oil and Hazardous Substances Pollution Contingency Plan
NEC	Natural Electrical Code
NFPA	Natural Fire Protection Association
NPL	Natural Priorities List
O_3	ozone
O&M	operation and maintenance
OD	outer diameter
ORP	oxidation-reduction potential
OSWER	EPA's Office of Solid Waste and Emergency Response
OU	operable unit
PCE	tetrachloroethene
PFD	process flow diagram
PLC	programmable logic controller
ppb	parts per billion
PQL	practical quantification limit
PRG	preliminary remediation goal
PRP	potentially responsible party
psi	pounds per square inch
PVC	polyvinyl chloride
POTW	Publicly Owned Treatment Works
QA	quality assurance
RA	remedial action
RAO	remedial action objective
RAWP	Remedial Action Work Plan
RD	remedial design
RDR	Remedial Design Report
RI	remedial investigation
RI/FS	remedial investigation/feasibility study
ROD	record of decision
ROI	radius of influence
RPO	remedial process optimization
RWQCB	Regional Water Quality Control Board

ACRONYMS AND ABBREVIATIONS (CONTINUED)

SAP	Sampling and Analysis Plan
SARA	Superfund Amendments and Reauthorization Act
SCADA	supervisory control and data acquisition
scfm	standard cubic feet per minute
SVE	soil vapor extraction
SVOC	semivolatile organic compound
TBC	to-be-considered
TCE	trichloroethene
TCP	trichloropropane
TDS	total dissolved solids
TEFC	totally enclosed, fan-cooled
URS	URS Group, Inc.
VC	vinyl chloride
VOC	volatile organic compound
μg/L	micrograms per liter

ES.0 EXECUTIVE SUMMARY

This Remedial Design Report (RDR) presents the detailed design of the selected remedial action (RA) for the groundwater Operable Unit 1 (OU1) at the Cooper Drum Company Site (Site), located at 9316 South Atlantic Avenue, in South Gate, Los Angeles County, California.

The OU1 (alternatively referred to as "impacted groundwater" or simply, "groundwater," throughout this report) RA includes remedial systems for the source area and hydraulic control (containment) and treatment for the leading edge of the groundwater plume.

The groundwater Source Area RA (Source Area System) consists of the following components:

- Injection of ozone and hydrogen peroxide into the source area groundwater (i.e., in situ chemical oxidation [ISCO] using injection wells that form a permeable barrier to groundwater flow);
- Extraction of groundwater downgradient of the ISCO barrier; and
- Aboveground treatment and re-injection of this extracted groundwater upgradient of the ISCO barrier.

The groundwater Downgradient Containment and Treatment RA (Downgradient Containment/Treatment System) includes:

- Extraction of groundwater near the leading edge of the plume;
- Installation of a permeable bioremediation barrier in the mid-plume area upgradient of the groundwater extraction; and
- Discharge to sanitary sewer, with pretreatment of the extracted groundwater, if needed.

This RDR provides the design criteria, including the design assumptions and parameters, used in developing the remedial design (RD) for OU1.

ES.1 SITE HISTORY

Since 1941, the Site was used by several companies to recondition and recycle used steel drums that once contained various industrial chemicals. The Cooper Drum Company operated from 1972 to 1992, reconditioning drums using a process that consisted of flushing and stripping the drums for painting and resale. Drum process waste was collected in open concrete sumps and trenches, resulting in releases to soil and groundwater beneath the site.

By 1992, when the drum reconditioning business had been sold to Waymire Drum Company, the Cooper Drum Company facilities were retrofitted to provide an aboveground, enclosed system for containing liquids and wastes. Closed-top steel tanks were installed over the sumps, and the trenches were replaced with hard piping. The former hard-wash area (HWA) was closed and replaced with a new HWA in the Drum Processing Area (DPA), which also provided hard piping and secondary containment. Waymire Drum Company continued to operate the facility until 1996. Consolidated Drum Company was the drum-reconditioning operator at the Site from 1996 until their departure in 2003. The facility was fitted to process plastic totes (large square containers) during this period.

Since 2003, drum processing operations no longer occur at the Site and all drum processing equipment has been removed from the Site. Following the removal the drum processing operations, there were four new tenants at the Site, including a pallet company, a trucking and towing company, and two automotive repair/ salvage companies. As of June 2006, the automotive repair/salvage companies moved operations off site and the pallet company expanded there operations to the vacant property.

The United States Environmental Protection Agency (EPA) conducted remedial investigation (RI) activities for Cooper Drum from 1996 to 2001. In June 2001, EPA added the Site to the National Priority List (NPL) of hazardous waste sites requiring remedial action. Site investigations conducted as part of the RI identified the former HWA as the primary source of contamination. The DPA also was identified as a source of contamination as a result of chemical spills that were documented during the 1980s. Following the remedial investigation/feasibility study (RI/FS) process, the Record of Decision (ROD) for the Site was signed on September 28, 2002.

ES.2 CONTAMINANTS OF CONCERN AND CLEANUP GOALS

Twelve hazardous substances are considered contaminants of concern (COCs) in OU1 groundwater: 1,2,3-trichloropropane (TCP); trichloroethene (TCE); 1,2-dichloroethane (DCA); vinyl chloride (VC); 1,2-dichloropropane (DCP); 1,1-DCA; cis-1,2-dichloroethene (DCE); tetrachloroethene (PCE); trans-1, 2-DCE; benzene; 1,1-DCE; and 1,4-dioxane.

Except for 1,4-dioxane, which is a semivolatile organic compound (SVOC), all the other COCs are volatile organic compounds (VOCs). As stated in the ROD, the remedial action objective (RAO) for groundwater is restoration of the groundwater (through treatment) for beneficial use. Therefore, the cleanup goal for the majority of the Site VOCs is to achieve maximum contaminant levels (MCLs). However, the cleanup goal for 1,2,3-TCP and 1,4-dioxane (for which an MCL has not been defined) is to achieve the practical quantification limit (PQL) and the preliminary remediation goal (PRG) for protecting sources of drinking water, respectively. See Table 2-1 for a list of all groundwater COCs and their respective cleanup goals.

ES.3 HYDROGEOLOGIC FEATURES

The main hydrogeologic features penetrated by borings and wells completed during the RI field investigation include the Bellflower Aquiclude, the perched aquifer, the Gaspur Aquifer, and the Exposition Aquifer. These units constitute a shallow aquifer and a deeper aquifer. The shallow aquifer consists of the saturated portion of the Bellflower Aquiclude, which incorporates the perched aquifer (approximately 35 to 40 feet below ground surface [bgs]), and the Gaspur Aquifer. The Bellflower Aquiclude extends to a depth of approximately 70 feet bgs, where the Gaspur Aquifer, which extends to a depth of approximately 110 to 120 feet bgs, underlies it. The upper portion of the deeper aquifer system is represented by the Exposition Aquifer, which underlies the shallow aquifer. The Exposition Aquifer has not been impacted by contamination originating from the Site.

Data from investigations at the Site and adjacent sites indicates that groundwater flows in a predominantly southerly direction. Additionally, the groundwater contamination from adjacent sites have commingled with and impacted the Site plume.

ES.4 ROD SELECTED REMEDY FOR OU1 GROUNDWATER

The Cooper Drum ROD (EPA, 2002) states the following selected remedy for the OU1 contaminated groundwater:

> "The cleanup strategy for groundwater contaminated with VOCs will use a combination of methods to achieve remedial goals and to restore the potential beneficial use of the aquifer as a drinking water source. An extraction/treatment system will be used for containment and remediation. Chemical in situ treatment will also be used to enhance the treatment of VOCs in groundwater, minimize the need for extraction, and reduce the potential for other VOC plumes in the vicinity to impact Cooper Drum."

The groundwater remedy design strategy, as described in Sections ES.5 and ES.6, respectively, for the contaminated plumes in the source area and the downgradient area, is consistent with the ROD selected remedy.

ES.5 DESIGN STRATEGY FOR OU1 SOURCE AREA

The remedial alternative selected to reduce COC concentrations in the OU1 Source Area is use of ISCO in conjunction with groundwater extraction, treatment, and injection. The OU1 Source Area Design is shown on Sheet C-1 of the design drawings, included under a separate tab to this volume (Volume I) of the report.

Ozone will be used as the primary oxidant during the ISCO activities. Hydrogen peroxide may also be used as a co-oxidant depending on site conditions and the results of the ozone-only injection. The remediation equipment will be capable of injecting both the oxidants.

The results of a bench-scale test and a field treatability test of ISCO, using ozone and hydrogen peroxide (O_3/H_2O_2), have indicated that complete destruction of the Site COCs can be achieved. The destruction mechanism is through direct oxidation by ozone, as well as oxidation by the hydroxyl radical, a potent and non-selective oxidizing reagent. The hydroxyl radical forms when ozone alone is applied, but its formation is enhanced when ozone is combined with hydrogen peroxide in appropriate molar ratios (i.e., less than 1.0 mole: mole of O_3/H_2O_2).

Oxidant injection wells will be installed in the source area (as delineated by a composite 100 parts per billion [ppb] concentration contour of TCE, cis-1,2-DCE, and 1,4-dioxane originating in the former HWA), forming a permeable, V-shaped barrier to the groundwater. Twelve new O_3/H_2O_2 injection wells (henceforth referred to as peroxone wells; denoted P_{ox}-1 through P_{ox}-12) will be installed in the source area. Three existing peroxone wells (M_{ox}-1, M_{ox}-2, and M_{ox}-3), previously used during the field treatability study, will also be utilized. The O_3/H_2O_2 will be supplied via a commercially available ISCO system. Additional components of the OU1 Source Area design strategy will include the following.

- Extraction of groundwater downgradient of the ISCO barrier.
- Aboveground treatment and injection of this extracted groundwater upgradient of the ISCO barrier.

The extraction well, installed downgradient of the ISCO barrier, will provide hydraulic control in the source area, and maximize groundwater flow through the permeable barrier. Based upon flow modeling results, use of groundwater extraction and injection upgradient may also shorten the cleanup time. The placement of the extraction will be geared toward capture of the 10 ppb isoconcentration contour for 1,4-dioxane and any portions of the source area plume that lie beyond the ISCO system area of influence. The extracted groundwater, estimated at approximately 25 gallons per minute (gpm), will be treated aboveground in a VOC and 1,4-dioxane treatment unit. This unit will also be used for cleanup of approximately 5 gpm of groundwater extracted from the perched aquifer (as described in the RDR for soil). A liquid-phase granular activated carbon (LGAC) unit will be used as required, to further polish the treated water. The treated groundwater, at a total rate of approximately 30 gpm, will then be injected into the shallow Gaspur Aquifer via two injection wells, at 15 gpm each, placed upgradient of the permeable ISCO barrier.

ISCO system operation is anticipated to continue over a period of three years, after which the capture and treatment of the residual COCs in groundwater would be addressed by the extraction/treatment system(s) in the source area and/or downgradient area. The ISCO remediation equipment will be housed on Site, in a closed warehouse located along Rayo Avenue, adjacent to the aboveground treatment compound.

ES.6 DESIGN STRATEGY FOR OU1 DOWNGRADIENT CONTAINMENT AND TREATMENT STRATEGY

The OU1 downgradient containment and treatment strategy includes extraction of groundwater at the leading edge of the OU1 contamination plume and the use of an in situ permeable bioremediation barrier (for enhanced reductive dechlorination) to expedite remediation of a portion of the plume between the source area system and the downgradient containment and treatment system.

Two groundwater extraction wells (designed to extract approximately 20 gpm each) will be installed at the leading edge of the 5 ppb TCE groundwater plume (downgradient of the source area extraction well, along McCallum Avenue). A 350-foot-long permeable bioremediation barrier also is to be installed upgradient of the extraction wells, along Southern Avenue, to enhance reductive dechlorination of VOCs in groundwater, as it flows across the barrier. The groundwater RA design currently includes piping of the extracted water back to the Source Area groundwater treatment plant and after treatment (including for 1,4-dioxane, if necessary), to discharge the water to the sanitary sewer location on site. However, a final determination as to whether pretreatment of the extracted water prior to discharge will be necessary can only be made when the two groundwater extraction wells are installed and sampled.

The placement and operation of the groundwater extraction wells will be designed to minimize the impact of adjacent plumes, while also providing hydraulic control of the groundwater through the permeable bioremediation barrier. The combined effect would be to further enhance/accelerate the treatment of Site groundwater and to reduce the time until cleanup goals are reached. Installation of a permeable bioremediation barrier along Southern Avenue would reduce the targeted treatment area for pump and treat to the area between Southern and McCallum Avenues. As mid-plume COC concentrations are biodegraded along Southern Avenue, the results of the Hydrogen Release Compound (HRC) pilot test and analytical pore volume modeling indicate that the required operation time of the extraction wells could be significantly reduced, possibly from upwards of 35 years down to 20 years or less.

1.0 INTRODUCTION

In June 2001, the United States Environmental Protection Agency (EPA) added the Cooper Drum Company Site (Site) to the National Priorities List (NPL) of hazardous wastes sites requiring remedial action. URS Group, Inc. (URS) completed a remedial investigation/feasibility study (RI/FS) report for the Site in May 2002. The RI/FS summarized previous investigations; the nature and extent of contamination; a human health risk assessment (HRA); contaminants of concern (COCs); remedial investigation (RI) activities, conclusions, and recommendations; remedial action objectives (RAOs); and an evaluation of remedial action (RA) alternatives. The selected RAs are detailed in the *Record of Decision, Cooper Drum Company, City of Southgate, California Record of Decision* (EPA, 2002). The Site has been categorized into two operable units (OUs) for the remedial phase: OU1 (alternatively referred to as "impacted groundwater" or simply, "groundwater," throughout this report) consists of the impacted shallow (Gaspur) aquifer; and OU2 consists of the impacted soil and a perched aquifer in the source area. This Remedial Design Report (RDR) presents the detailed design for the groundwater (OU1) RA. The detailed design for the soil and perched aquifer (OU2) RA is presented in the report titled *Soil Remedial Design Report Operable Unit 2 Cooper Drum Company Superfund Site* (URS, 2007a).

1.1 PURPOSE AND OBJECTIVES

This RDR presents the design for the selected impacted groundwater RA at the Cooper Drum Company Site in South Gate, Los Angeles County, California (see Figure 1-1). The groundwater RA includes remedial systems for the source area and hydraulic control (containment) and treatment for the leading edge of the groundwater plume.

The groundwater Source Area RA (Source Area System) consists of the following components:

- Injection of ozone and hydrogen peroxide into the source area groundwater (i.e., in situ chemical oxidation [ISCO] using injection wells that form a permeable barrier to groundwater flow);
- Extraction of groundwater downgradient of the ISCO barrier; and
- Aboveground treatment and re-injection of this extracted groundwater upgradient of the ISCO barrier.

The groundwater Downgradient Containment and Treatment RA (Downgradient Containment/Treatment System) includes:

- Extraction of groundwater near the leading edge of the plume;
- Installation of a permeable bioremediation barrier in the mid-plume area upgradient of the groundwater extraction; and
- Discharge to sanitary sewer, with pretreatment of the extracted water, if needed.

This RDR provides the design criteria, including the design, assumptions, and parameters used in developing the groundwater remedial design (RD). The RA was selected in accordance with the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) of 1980, as amended by the Superfund

Amendments and Reauthorization Act of 1986 (SARA), and, to the extent possible, the National Oil and Hazardous Substances Pollution Contingency Plan (NCP). The selection was based on the Administrative Record file for the Cooper Drum Company Site and is detailed in the Record of Decision (ROD) (EPA, 2002).

As stated in the ROD, the cleanup strategy for the Site will use a combination of methods to achieve remedial goals:

- An extraction/treatment system will be used for containment and remediation;
- In situ treatment, in the form of oxidation and/or enhanced reductive dechlorination, will also be used to enhance the treatment of volatile organic compounds (VOCs) in groundwater, minimize the need for extraction, and reduce the potential impact for other VOC plumes in the vicinity to impact Cooper Drum; and
- Treated groundwater will be reinjected into the contaminated aquifer, and/or discharged to the Publicly Owned Treatment Works (POTW) sanitary sewer system.

The RA for impacted groundwater as delineated in this RDR encompasses all the components of the ROD selected remedy. The only exception to the ROD is the addition of the semivolatile organic compound (SVOC) 1,4-dioxane as a Site groundwater COC, as a result of the discovery of this compound during the RD investigation. An advanced oxidation process has been added to the RA to address remediation of this SVOC in the groundwater.

The RA for impacted soil is presented in the above-referenced design document (URS, 2007a). The proposed OU2 soil RA includes:

- Dual-phase extraction (DPE) in two areas of the Site that are believed to be the source areas for vadose zone contamination: the former Hard Wash Area (HWA) and the Drum Processing Area (DPA) (see Figure 1-2);
- The DPE will include soil vapor extraction (SVE) and dewatering of the shallow perched zone, which appears to be continuous beneath the Site;
- Groundwater extracted from the perched aquifer will be treated with an ex situ (aboveground) treatment system; and
- The treatment system effluent will be reinjected into the shallow aquifer along with groundwater from the herein described Source Area RA.

It is anticipated that the OU2/soil RA will be performed prior to, or concurrently with, the OU1/groundwater RA. For improved cost-effectiveness, the same ex situ groundwater treatment system can be used for both OUs. The proposed ISCO barrier in the groundwater source area would be directly beneath the DPE system in the HWA. Therefore, concurrent operation of the groundwater and soil RAs would also afford control of ozone and other off-gases that may escape into the vadose zone from the groundwater.

1.2 SITE DESCRIPTION AND HISTORY

1.2.1 Site Description

The Site is located at 9316 South Atlantic Avenue in South Gate, Los Angeles County, California. It is identified as EPA ID CAD 055753370 (Latitude 33 56' 49" N, Longitude 118 11'42"W). The Site, which consists of 3.8 acres of mixed residential, commercial, and industrial land use, is 10 miles south of Los Angeles and approximately 1,600 feet west of the Los Angeles River (Figure 1-1). Site facilities include drum processing and storage areas, an office, a warehouse, and maintenance buildings. The HWA is in the northeastern area of the Site, which also includes a covered shed area. The drum processing building, which is referred to as the DPA in this report, is located along the southern property boundary. All buildings have concrete floors, and the entire facility has been asphalt-paved since 1986. The Tweedy School on the adjacent property has been closed since 1988 because of a concern that children attending the school could be exposed to contamination migrating off site.

1.2.2 Site History

Following is a history of the Site use for the reconditioning and recycling of steel drums containing residual chemicals.

- Since 1941, the northern portion of the Site has been owned and operated by drum recycling companies. The use and ownership of the southern portion of the Site prior to 1971 is unclear. The Cooper Drum Company purchased both parcels and operated the facility from 1972 until 1992.
- Reconditioning activities took place within the present-day DPA (Figure 1-2), in the central portion of the Site. When necessary, heavy duty cleaning, called "hard washing," was performed in the northeastern portion of the Site (the former HWA shown on Figure 1-2). Caustic fluids, generated by reconditioning and hard washing activities, and waste materials removed from inside the drums were collected in open concrete sumps and trenches. This led to the contamination of the soil and groundwater beneath the Site. Recent investigations have shown that most contamination at the Site can be traced to the HWA and the DPA.
- By 1992, when the drum reconditioning business had been sold to Waymire Drum Company, the Cooper Drum Company facilities were retrofitted to provide an aboveground, enclosed system for containing liquids and wastes. Closed-top steel tanks were installed over the sumps, and the trenches were replaced with hard piping. The former HWA was closed and replaced with a new HWA in the DPA, which also provided hard piping and secondary containment.
- Waymire Drum Company continued to operate the facility until 1996. Consolidated Drum Company was the drum-reconditioning operator at the Site from 1996 until their departure in 2003. The facility was fitted to process plastic totes (large square containers) during this period.

By 1992, an aboveground, enclosed system was used for containing liquids and wastes. The Cooper Drum Company continued to operate the facility until 1992. In 1992, the drum reconditioning business was sold to Waymire Drum Company, which operated the facility until 1996. Since 1996, Consolidated Drum Company has been the drum-reconditioning operator at the Site. The facility was fitted to process plastic totes (large square containers) during this period.

1.2.3 Current Site Operations

Consolidated Drum Company terminated its lease with the Cooper Trust in October 2003 and moved its operations to off-site facilities. All drum-recycling equipment and associated containment piping and tanks were removed from the Site. Currently, the Site is fully operational; however, drum operations no longer occur at the Site. There were four new tenants, including a pallet company, a trucking and towing company, and two automotive repair/salvage companies. As of June 2006, the automotive repair/salvage companies moved operations off-site and the pallet company expanded its operations to the vacant property.

1.3 Report Organization

This RDR includes the following:

- Section 1.0 A brief introduction of the Site, Site history and current Site operations
- Section 2.0 A summary of the remedial investigations performed at the Site
- Section 3.0 A summary of the Record of Decision for the Site
- Section 4.0 The general design strategy and detailed design for the remediation of impacted groundwater
- Section 5.0 The construction and implementation details
- Section 6.0 The environmental and public impact reduction plan
- Section 7.0 References

2.0 REMEDIAL INVESTIGATION SUMMARY

2.1 PREVIOUS INVESTIGATIONS

From 1984 through 1989, the Los Angeles County Department of Health Services (LACDHS) issued several Notices of Violation to the Cooper Drum Company as a result of incidents involving the release of hazardous substances at the Site. The LADHS required the Cooper Drum Company to conduct investigations of soil and groundwater. In 1989, the California Department of Health Services, now known as the Department of Toxic Substances Control (DTSC), also collected soil samples from under the DPA. These studies, coupled with investigations conducted as part of the RI/FS, identified 13 hazardous substances as COCs in groundwater. Except for 1,4-dioxane, which is considered an SVOC, all the other Site COCs are VOCs. The groundwater COCs and their cleanup levels are listed in Table 2-1.

Under LADHS direction, consultants for the Cooper Drum Company excavated and removed contaminated soil from the property and from the adjacent Tweedy Elementary School, after caustic fluids leaked from trenches under the DPA building onto school property. To assess impacts to groundwater in the uppermost aquifer beneath the Site (approximately 40 to 80 feet below ground surface [bgs]), four monitoring wells were installed on Site and one upgradient well was installed off Site.

The groundwater beneath the Site was identified as contaminated with VOCs. In 1987, the City of South Gate closed four municipal water supply wells found to contain PCE. These wells are in South Gate Park, within 1,500 feet southwest of the Site. At that time, the City listed the Cooper Drum Company as a possible source of the PCE contamination; however, recent investigations indicate that groundwater contamination found beneath the Site did not contribute to the deeper groundwater contamination affecting those municipal wells. The groundwater contamination originating from the Site is moving to the south, not toward the municipal wells. It is confined to the upper aquifer and is not currently affecting any drinking water supplies in the City of South Gate, because the municipal wells are completed in deeper aquifers.

The Tweedy School, on the adjacent property, was closed in 1988 because of the concern that children attending the school could be exposed to contamination migrating from the Site and from other industrial operations in the area.

Based on the discovery of the soil and groundwater contamination, EPA first proposed the Cooper Drum Company Site for inclusion on the NPL in 1992. EPA issued the General Notice and 104(e) letters to the Cooper Drum Company owners and operators at that time. During 1993, EPA met with Arthur Cooper, the Site owner and previous operator (before Waymire Drum Company took over operations in 1992), who was considered a potentially responsible party (PRP). The purpose of the meeting was to discuss the special notice letter EPA was planning to send to him and to begin negotiations for an Administrative Order on Consent (AOC) to conduct the RI. Later that same year, the Cooper estate declared bankruptcy upon the death of Mr. Cooper. Given its lack of assets, the Cooper estate was no longer considered a viable PRP to help pay for the Cooper Drum Company investigation and remediation. Consequently, the Site became a fund-lead site, where Superfund trust fund money is used for Site activities. Based on additional Site investigation data collected by EPA, the Site was proposed for the NPL in January 2001. In June 2001, the EPA added the Site to the NPL of hazardous waste sites requiring remedial action.

EPA conducted the RI activities for Cooper Drum from 1996 to 2001. EPA initiated a soil gas survey in 1996 to identify potential hot spots (areas where contaminant concentrations of VOCs are the highest) for a Phase 1 RI. This investigation identified "hot spots" in the vicinity of the former HWA, in the northeastern portion of the property, and in the DPA, in the central portion of the property. The Phase 1 RI was designed to further investigate the potential presence of VOCs, SVOCs, and metals in soil and groundwater beneath the Site and the adjacent Tweedy School property. Based on the results of the Phase 1 RI, EPA expanded its investigation of soil and groundwater to delineate the extent of contamination as part of a Phase 2 RI conducted between September 1998 and March 2001. The complete RI report, Cooper Drum Remedial Investigation Feasibility Study Report (the Site RI/FS) (URS, 2002) was released in May 2002.

The main hydrogeologic features penetrated by borings and wells completed during the RI field investigation include the Bellflower Aquiclude, the perched aquifer, the Gaspur Aquifer, and the Exposition Aquifer. These units constitute a shallow aquifer and a deeper aquifer. The shallow aquifer consists of the saturated portion of the Bellflower Aquiclude, which incorporates the perched aquifer (approximately 35 to 40 feet bgs) and the Gaspur Aquifer. The Bellflower Aquiclude extends to approximately 70 feet bgs, where the Gaspur Aquifer, which extends to a depth of approximately 110 to 120 feet bgs, underlies it. The upper portion of the deeper aquifer system is represented by the Exposition Aquifer, which underlies the shallow aquifer. These hydrogeologic units are presented on generalized geologic cross-sections shown in Figure 2-1.

Nearby properties have undergone investigation as sources of groundwater contamination under the direction of the Los Angeles Regional Water Quality Control Board (RWQCB), including the Jervis Webb site (north of the Site), two former Dial Corporation sites (northeast and east of the Site), and the Seam Master site (southeast of the Site). Data from investigations at these three sites indicate that groundwater flows in a southerly direction. High TCE concentrations in the shallow aquifer have been detected under the Jervis Webb site (33,000 parts per billion [ppb]) and in a downgradient monitoring well (6,700 ppb) 200 feet upgradient from and northeast of the Site. Similar TCE concentrations (up to 16,000 ppb) have been detected in the groundwater beneath the Seam Master site. Given its proximity, the groundwater contamination from Jervis Webb may have commingled with and impacted the Cooper Drum Site plume. Based on investigation activities performed during the RD, groundwater contamination from the Seam Master site has commingled with the downgradient (outside the property boundary) portion of the Cooper Drum Plume. The need to reduce commingling of these two plumes was an important consideration during remedy selection.

The RI/FS (URS, 2002) confirmed that waste collected in open concrete sumps and trenches resulted in releases to soil, and that migration of some of these contaminants impacted the shallow aquifer beneath the Site. The primary source of contamination was the HWA, where drum-processing operations took place until 1976, when they were moved to the DPA on the southern side of the property. The DPA also became a source of contamination as a result of chemical spills that were documented during the 1980s. Beginning in 1987, the Cooper Drum Company facilities were upgraded to prevent any further release of chemical wastes and to meet environmental regulations. By 1992, the former HWA was closed and replaced with a new HWA in the DPA and aboveground, enclosed systems were in place.

Site operations have resulted in the discharge of contaminants to the surface soil, vadose zone, and underlying groundwater. Various chemicals have been released to the Site and VOCs and SVOCs are found in both the vadose zone and groundwater.

2.2 SUPPLEMENTAL RI DATA

The ROD for the Cooper Drum Site was signed on September 28, 2002. The ROD-selected groundwater RA is discussed in Section 3.0 of this RDR.

California DTSC agreed with the selected groundwater remedies stated in the ROD, provided additional data were collected to address data gaps prior to implementation of the selected remedies. EPA included the following component in the selected groundwater remedy to address these concerns.

- Conduct additional groundwater sampling to further define the downgradient extent of the VOC contamination (beyond the property boundary).

This component was addressed and reported in the *Remedial Design Technical Memorandum for Field Sampling Results* (URS, 2006a). Reported data pertinent to soil, soil gas, and the perched aquifer was also presented in the soil RDR (URS, 2007a). However, it was noted in the above-mentioned technical memorandum that additional groundwater sampling was required to accurately define the southeastern groundwater plume boundary. In order to accomplish this, additional depth-discrete groundwater sampling using cone penetrometer testing (CPT) and HydroPunch sampling was conducted during February/March of 2007 and the results were reported in *Addendum No. 2* to the field sampling results (URS, 2007b). This addendum is included as Appendix B to this report. A summary table of historical VOC and 1,4-dioxane groundwater sampling results are also included in Appendix B.

A discussion of the rationale for the CPT/HydroPunch investigation is provided in Section 2.4.1. A summary of the investigation results is presented in Section 2.4.2. On the basis of these results, recommendations for installation of new monitor wells are provided in Section 2.5.

2.2.1 Rationale for the 2007 CPT/HydroPunch Investigation

The 2007 CPT/HydroPunch investigation was performed by EPA to further define the lateral extent of the Cooper Drum Plume and complete the RD for the Site. The CPT/HydroPunch data provide the basis for selecting the locations of new monitor wells. At this time, monitor wells have only been installed within the Cooper Drum plume. New monitor wells would provide a fixed sampling location to:

- Determine groundwater flow direction downgradient of the Site;
- Define plume boundaries;
- Monitor plume migration off-Site; and
- Gauge the effectiveness of remedial actions.

In addition to the above-mentioned reasons, new monitor wells outside the Cooper Drum plume are required to verify the location of other plumes. During the CPT/HydroPunch investigation, depth-discrete groundwater samples collected outside the Cooper Drum plume indicated that the Site plume is commingling with an adjacent plume.

2.2.2 2007 CPT/HydroPunch Sampling Results

Five CPT/HydroPunch borings (CPT-40 through CPT-45) and four HydroPunch-only borings (HydroPunch-8, HydroPunch-26, HydroPunch-35, and HydroPunch-36) were installed between February 26 to March 1, 2007 to obtain lithologic data and/or depth-discrete groundwater samples to further delineate the groundwater contamination. Figure 2-2 shows the CPT and HydroPunch boring locations. The HydroPunch borings were installed at locations which had been sampled during prior investigations (i.e., CPT-8, CPT-26, CPT-35 and CPT-36); therefore, these locations were designated with an HydroPunch, because lithologic data was available from CPTs in the vicinity of the HydroPunch borings.

The lithologic data from the new CPTs were consistent with prior data, which indicated the presence of a relatively sandy unit from approximately 60 to 100 feet bgs. This unit begins in the eastern portion of the Site along Rayo Avenue, and trends to the south and southeast.

VOC and 1,4-dioxane analytical data for the February/March 2007 sampling event are presented in Table 1 of Appendix B (included in Volume II of this report). Select VOC and 1,4-dioxane results are presented on Figure 2-2, which has an expanded base map and also includes the August 2006 TCE results from monitor wells (URS, 2007c). TCE concentrations are considered representative of the lateral extent of the Cooper Drum plume. Results from the February/March 2007 CPT/HydroPunch investigation indicate the following:

- The leading edge of the Cooper Drum plume (as represented by TCE) appears to be slightly south of McCallum Avenue, as depicted on Figure 2-2. The estimated Cooper Drum plume boundary and the plume(s) boundary(s) to the east cannot be finalized until the groundwater flow direction and COC concentrations can be established, based on sampling results from proposed new monitor wells. Based on the current monitor well data, the recent CPT/HydroPunch data, and the water level data from the Cooper Drum Site, the 5 micrograms per liter (µg/L) TCE contour line boundary for the Site plume was estimated for the purpose of developing the groundwater remedial design. Note that an estimated area of plume convergence (commingling with off-site plumes) is depicted on Figure 2-2.
- VOC concentrations in the downgradient area of the Cooper Drum plume appear to be higher in the lower portion (90 to 110 feet bgs) of the Gaspur Aquifer.
- Concentrations (up to 830 µg/L of TCE) of VOCs south of Southern Avenue are significantly above those observed in the Cooper Drum plume. These elevated VOC concentrations are present from the depth range of approximately 62 to 85 feet bgs, beginning at CPT-40 and continuing to the south at CPT-41, CPT-42 and CPT-45. The VOCs would appear to be emanating from the area of CPT-10 and CPT-21, located in the eastern portion of the Seam Master site. Results from these two CPTs have shown TCE concentrations of up to 16,000 µg/L from this depth range. Assuming the source of VOCs at CPT-45 is from the Seam Master site, groundwater flow directions may be south to southwest.
- The high TCE concentration at the 100-foot bgs depth from CPT-40 (as compared to the shallower results) suggest this contamination may not be associated with the Seam Master site and could be associated with the Jervis Webb site and/or the Cooper Drum plume. Further investigations are required to determine the source of this contamination.
- 1,4-Dioxane concentrations appear to higher in the Cooper Drum plume, as compared to results from the CPTs sampled to the east and downgradient of the Cooper Drum plume. Generally, all

1,4-dioxane results from CPT-40 to CPT-42 and CPT 45 were less than 2 µg/L. The only exception would be the 88-foot bgs sample from CPT-40, which showed a 1,4-dioxane concentration of 12 µg/L.

On the basis of the above sampling results, recommendations for new monitor wells are provided in Section 2.5.

2.3 RECOMMENDATIONS FOR NEW MONITORING WELLS

As discussed above, monitor well installations are necessary to confirm the CPT/HydroPunch depth-discrete sampling results, establish groundwater flow patterns, track plume migration, and evaluate the RA performance. Well installations are also necessary within and to the south of the Seam Master Site to further characterize VOC contamination in that area.

To characterize the Cooper Drum plume, recommendations for new monitor well installation are:

- To address the downgradient extent of the Cooper Drum Plume, two monitor well pairs completed in the middle and lower portion of the shallow Gaspur Aquifer are recommended on McCallum Avenue, in the vicinity of CPT-44 and CPT-43 (see proposed new wells MW-34A/B and MW-35A/B on Figure 2-3).
- Two monitor wells completed in the lower portion of the Gaspur Aquifer at the locations of MW-25 and MW-31 are recommended (see proposed new wells MW-25B and MW-31B on Figure 2-3). At these locations, existing wells MW-25 and MW-31 are completed in the middle portion of the Gaspur Aquifer; and MW-26 and MW-32 are completed in the upper portion of the deeper Exposition Aquifer.
- One monitor well screened from 85 to 90 feet in the Gaspur Aquifer, to be located in the vicinity of CPT-35, adjacent to the curb line on Southern Avenue is recommended (see proposed new well MW-38A on Figure 2-3).
- One monitor well pair completed in the middle and lower portion of the shallow Gaspur Aquifer in the vicinity of CPT-22, inside the Site fence line (see proposed new wells MW-39A/B on Figure 2-3).

Data from the proposed new wells would be used to (1) further characterize COC distribution in the Cooper Drum plume and (2) evaluate the effectiveness of the ISCO barrier in the source area and the permeable bioremediation barrier to be installed along Southern Avenue as part of the RA.

Regarding the Site plume commingling with the adjacent plumes to the east, the following recommendations are made:

- Install one monitor well pair to be completed in the middle and lower portion of the shallow Gaspur Aquifer and located on Southern Avenue in the vicinity of CPT 40 (see proposed new wells MW-37A/B on Figure 2-3). The deeper well would be useful to address deep contamination which may be related to upgradient sources. Water levels from these locations should assist in establishing flow directions from the Seam Master site.

- Install one monitor well pair to be completed in the middle and lower portion of the shallow Gaspur Aquifer and located on Adella Avenue, approximately 100 feet south of the intersection of McCallum Avenue (see proposed new wells MW-36A/B Figure 2-3). It is expected that the well completed in the lower Gaspur Aquifer (approximately 95 to 110 feet bgs) would define the downgradient extent of the Cooper Drum plume, since the VOC concentrations above this depth interval appear to be significantly higher than in other areas of the Cooper Drum plume and not attributed to it.

Therefore, the groundwater RA includes the installation of 13 new monitor wells. As shown on Figure 2-3 and discussed in Section 4.2, the RA also includes installation of three new groundwater extraction wells. One well (SEW-1) will be installed just south of the Site along Rayo Avenue and two wells (DEW-1 and DEW-2) will be installed farther south, along McCallum Avenue. Sheet C-6 (Volume I) shows the design drawing for typical single-completion monitor wells and extraction wells.

Until the new monitor wells are installed, there will remain some uncertainty regarding the treatment requirements for the groundwater extracted by the downgradient extraction wells. For example, it is possible that 1,4-dioxane concentrations may be low enough so as to not require treatment. However, based on VOC sample results from the existing monitor wells and from CPT locations, it is expected that VOC concentrations will be greater than cleanup goals and will, therefore, require treatment. Based on these expectations, and in order to effectively use the Site property and existing infrastructure, the groundwater RA design currently includes piping of the extracted water from the downgradient area back up to the Site groundwater treatment compound for treatment of VOCs and, if required, 1,4-dioxane. A final determination as to whether treatment of this water will be required can only be made after the two new extraction wells are installed and additional sampling data are collected prior to implementation of the RA.

2.4 PILOT STUDY RESULTS AND JUSTIFICATION OF DESIGN ASSUMPTIONS

Two field-scale pilot studies have been completed as part of implementation of the RA:

- Hydrogen Release Compound (HRC) Field Pilot Study (URS, 2005)
- ISCO Field Pilot Study using Ozone and Hydrogen Peroxide (URS, 2006b).

2.4.1 HRC Pilot Test Description

The objective of the HRC field pilot study, performed in December 2003, was to evaluate the effectiveness of enhanced reductive dechlorination in reducing VOC concentrations in the Site groundwater. The pilot test comprised of injecting a combination of a less viscous form of HRC (referred to as "HRC primer"), and HRC with added iron gluconate (referred to as "modified HRC") into the contaminated groundwater. Prior to the field test, it was surmised that the presence of high levels of sulfate naturally present in Site groundwater (at levels of up to several thousand milligrams per liter) might compromise the technology's effectiveness because sulfate and other soil and groundwater constituents compete for the donated electrons (which are provided by hydrogen that is released as HRC degrades). Sulfate reduction is not necessarily desirable, because it may result in a build-up of sulfides which can, in turn, lead to "sulfide toxicity" and loss of microbial populations in the aquifer. On the other hand, if the produced sulfide binds with metals, for example with iron naturally present in groundwater or iron introduced by the modified HRC, it will likely precipitate in the form of iron sulfides. Therefore, it was hoped that the modified HRC would provide adequate iron to promote iron sulfide precipitation. The purpose for injection of the less viscous HRC primer was to provide an easily accessible source of hydrogen (electrons), in order to satisfy the electron demand of the competing soil and groundwater constituents.

The HRC test consisted of injecting approximately 4,500 pounds of substrate into a 15-foot by 25-foot grid area (see Figure 2-4, HRC area) in the Site source area. The HRC area is approximately 100 feet upgradient from the ISCO field pilot test area; therefore, contamination originating in the HRC area was expected to impact the oxidation pilot study area after approximately 10 months. The results of groundwater sampling after the start of the HRC pilot study indicated that injection of HRC promoted and enhanced anaerobic bacterial activity and reductive dechlorination, without a significant increase in sulfide concentrations, within distances of 50 feet or more directly downgradient from the test area. (See Appendix D, Volume II, of this report for VOC concentration trends over time in the study area monitor wells.) Based on these results, full-scale application of HRC would be feasible to treat VOCs in groundwater but not to treat 1,4-dioxane (an SVOC) in groundwater. As mentioned above, 1,4-dioxane has been detected in Site groundwater, at levels ranging from below detection levels to several hundred micrograms per liter. By comparison, the drinking water preliminary remediation goal (PRG) for 1,4-dioxane is 6.1 µg/L, and the Department of Health Services (DHS) action level for this compound is 3 µg/L. It was because of the presence of 1,4-dioxane that the ISCO field pilot study was performed.

2.5 ISCO PILOT TEST SUMMARY

This section details the highlights of the ISCO pilot study conducted from July 2005 through June 2006. Additional relevant results and figures are provided in Appendix D, Volume II, of this report. The main purpose of the pilot study was to determine whether inclusion of ISCO in the groundwater remedy for the Site was required to effectively reach the groundwater aquifer cleanup levels. The data monitoring and sampling procedures were geared towards evaluating system performance and checking for reducing COC concentrations without significant rebound. The ISCO technology employed was an advanced oxidation process (AOP) using the application of ozone and hydrogen peroxide.

2.5.1 ISCO Pilot Test Description and Results

The positive findings from an ozone/hydrogen peroxide bench scale study (PRIMA Environmental, 2005) warranted further evaluation during a field pilot-scale study of the technology. The pilot study was conducted approximately 140 feet downgradient from the former HWA, the main contaminant source area. The pilot study installation consisted of a barrier configuration with three ozone/hydrogen peroxide injection wells laterally spaced from 35 and 50 feet apart. The pilot scale study layout is shown on Figure 2-4. Each injection well contained two injection points at approximately 70 and 90 feet bgs (see Figure 2-5). The pilot study monitoring wells (extraction well [EW]-1, monitoring well [MW]-33A/33B, and MW-20/20B) were located downgradient and within a maximum of 30 feet of the three injection wells (M_{OX}-1, M_{OX}-2, and M_{OX}-3). Each monitoring well location included a shallow (approximately 60 to 63 feet bgs) and deep (85 feet bgs) sampling depth.

The pilot study took place over a period of 321 days (approximately 10.5 months). The following general schedule of oxidant injection was employed during this period.

- Ozone only for the first 5 months (148 days) in the three injection wells. Ozone was injected at a rate of 0.5 pound per day for 50 days and then increased to 2 pounds per day for the remainder of the 5-month period.
- Ozone and hydrogen peroxide for the remaining 5.5 months.
- Increasing the ozone and hydrogen peroxide injection rates by focusing the injection into only two injection wells after 8 months, or 244 days. This phase was referred to as "focused injection."
- Increasing the ozone injection rate (by adding a second ozone generator) from 2 to 4 pounds per day, and reducing the hydrogen peroxide injection rate to 0.7-to-1 moles peroxide per moles ozone (mole: mole) after just over 9 months (281 days), and for the remaining 40 days of the pilot study.

Optimal system operating parameters were eventually achieved by performing the following:

- Using continuous downhole monitoring of the dissolved oxygen (DO) and oxidation reduction potential (ORP) to evaluate the lateral and vertical effect of varying the operating parameters, such as oxidant injection cycles and injection locations;
- Focusing/increasing oxidant injection into two injection wells (M_{OX}-1 and M_{OX}-2);
- Reducing the hydrogen peroxide injection rate; and
- Increasing the ozone injection rate from approximately 2 pounds per day to 4 pounds per day.

Air was also injected following each oxidant injection to enhance oxidant distribution. The air volume was increased from 1.1 to 2.2 standard cubic feet per minute (scfm) after 99 days, and then decreased back to 1.1 scfm after 244 days for the remainder of the pilot study.

Over the first 5 months of the pilot study, COC concentrations generally showed an overall decreased in the three shallow monitor wells and one deep well (one shallow well, MW-33A, showed an increase in TCE prior to the end of the 5-month period). After the 5-month period, when both ozone and hydrogen peroxide were being injected, COC concentrations increased slightly and/or stabilized in the two shallow monitor wells (EW-1 at 63 feet bgs [EW-1-63'] and MW-20) and one deeper well (EW-1 at 85 feet bgs [EW-1-85']). The stabilized state persisted in one shallow well (EW-1-63') and continued even after initiation of the focused injection. However, the sampling results at this well conducted 40 days after the ozone injection rate was increased from 2 to 4 pounds showed a decrease of 350 µg/L of 1,4-dioxane and 135 µg/L of TCE. At MW-33A, where TCE concentrations increased prior to the injection of hydrogen peroxide (i.e., towards the end of the first 5-month period), the other COC concentrations continued to show an overall decreasing trend throughout the pilot study. TCE concentrations eventually decreased at this well by 490 µg/L. 1,1-DCA concentrations decreased by an average of 73% in the three shallow wells; this is notable, considering the reluctant nature of chlorinated ethanes to oxidation. Monitoring of the third shallow well (MW-20) was discontinued after injection in the closest injection well (M_{OX}-3) was terminated, as part of the focused injection phase.

In summary, in situ oxidation of Site COCs (including TCE, DCE, DCA, and 1,4-dioxane) was observed in all wells, with significant reductions (up to 90%) in both TCE and 1,4-dioxane concentrations. The largest decreases in concentrations were observed from the three shallow monitoring wells.

Based on the successful destruction of VOCs and 1,4-dioxane, the use of ISCO is now included in the full-scale remedial system for the Site.

3.0 SUMMARY OF RECORD OF DECISION

The ROD for the Cooper Drum Site was signed on September 28, 2002. At the time, the known contaminants in groundwater consisted of VOCs only; therefore, the ROD did not make specific mention of 1,4-dioxane. However, by maintaining a comprehensive approach to cleanup, which employed the use of both in situ and ex situ technologies for cleanup and containment, the ROD-selected remedy for groundwater remains viable for all Site COCs. The RAOs for Cooper Drum, as stated in the ROD, are to protect human health and the environment from exposure to contaminated soil, groundwater, and indoor air, and to restore the groundwater to a potential beneficial use as a drinking water source. The ROD-selected remedy meets these RAOs through treatment of soil and groundwater contaminated with COCs.

3.1 SELECTED ACTION FOR GROUNDWATER

The following paragraphs are excerpts from the Cooper Drum ROD:

- The cleanup strategy for groundwater will use a combination of methods to achieve remedial goals and to restore the potential beneficial use of the aquifer as a drinking water source.
- An ex situ treatment component, consisting of a groundwater extraction and treatment system, will be used for containment and remediation. This ex situ treatment component will utilize presumptive technologies identified in Directive 9283.1-12 from EPA's Office of Solid Waste and Emergency Response (OSWER). One of the presumptive technologies (GAC) will be used for treating aqueous contaminants in the extracted ground water.
- In situ chemical treatment—reductive dechlorination and/or oxidation—will also be used to enhance the treatment of VOCs in groundwater and to minimize the need for extraction and ex situ treatment.
- The actual technologies and sequence of technologies used will be determined during RD. Final selection of these technologies will be based on the outcome of treatability studies to be performed during the RD.

The EPA believes the selected remedy for Cooper Drum meets the threshold criteria and provides the best balance of tradeoffs among the alternatives considered. The EPA expects the selected remedy to satisfy the statutory requirements of CERCLA Section 121(b): (1) protection of human health and the environment; (2) compliance with applicable or relevant and appropriate requirements (ARARs); (3) cost effectiveness; (4) use of permanent solutions and alternative treatment technologies to the maximum extent practicable; and (5) use of treatment as a principle component.

3.2 DETAILED DESCRIPTION OF THE ROD-SELECTED REMEDY

The selected remedy consists of extracting COC-contaminated groundwater and treating it aboveground. In situ chemical treatment—reductive dechlorination and/or chemical oxidation—would be used to expedite and enhance treatment, and to reduce the volume of extracted water. The various components of the selected remedy, as described in the Cooper Drum ROD, are:

- Extract groundwater contaminated with VOCs and treat it using liquid-phase activated carbon in vessels at an on-site treatment system. Containment will be provided at the downgradient extent of contamination.
- The treated water will be reinjected into the contaminated groundwater aquifer or discharged to the public sewer system operated by the Los Angeles County Sanitation District (LACSD). Reinjection will reduce the intrusion of and the potential for mixing with other off-site VOC plumes.
- Use in situ chemical treatment, either reductive dechlorination or chemical oxidation, to enhance remediation of VOC-contaminated groundwater. During the remedial design phase, conduct treatability studies to evaluate both methods and determine which works best under site conditions. Data obtained from pilot studies will also be used to determine the specific number and placement of in situ injection points.
- Conduct additional groundwater sampling during the RD phase to further define the downgradient extent of the VOC contamination.
- Continue groundwater monitoring for a period of three years after the monitoring demonstrates that remediation goals have been met.

The ROD also stated the time to reach remedial action goals as 20 years. However, it was noted that the actual time required for active cleanup could be reduced if the in situ chemical treatment was proven effective. Depending on the effectiveness of in situ chemical treatment, monitoring could be the only action needed at Cooper Drum within 5 to 10 years of start of remediation.

3.3 RATIONALE FOR THE SELECTED REMEDY

The principal factors considered in choosing the selected remedy for groundwater are:

1. There is no source material or non-aqueous phase liquids (NAPLs) in the groundwater constituting a principal threat;
2. Low level extraction provides an effective means of minimizing migration of the leading edge of the contaminant plume, without further commingling of on- and off-site plumes;
3. Reinjection of a portion of the treated ground water will enhance recovery of contaminants from the aquifer and will reduce the plume commingling potential;
4. Supplemental in situ chemical treatment may expedite cleanup and reduce volume and toxicity of contaminants in place; and
5. Depending on the success of the in situ chemical treatment, monitoring may become the only action needed at Cooper Drum within 5 to 10 years if it can be demonstrated that contaminant concentrations in the groundwater plume have stabilized at reduced concentrations.

3.4 COMPLIANCE WITH APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS (ARARS)

Remedial actions selected under CERCLA must comply with ARARs under federal environmental laws or under State environmental or facility-siting laws when those are more stringent than the federal requirements. The ARARs and to-be-considered (TBC) criteria identified in the ROD for the groundwater remedy are included in Appendix C.

If after implementation of the remedy, hazardous waste still remains at the property at levels which are not suitable for unrestricted use of the land, additional institutional controls may be required in the form of a State Land Use Covenant with the property owner. The Covenant shall conform with the requirements of pursuant to Civil Code section 1471, Health and Safety Code section 25355.5 and the California Code of Regulations, Title 22, section 67391.1. However, remediation of groundwater will be required to meet all applicable cleanup goals. Therefore, institutional controls will not be needed for OU1 groundwater.

4.0 DETAILED DESIGN FOR GROUNDWATER REMEDIATION

The following section details the basis for the groundwater remedial design for contaminated groundwater. The design closely follows the ROD selected remedy for groundwater, as delineated in Section 3.0. However, the role of chemical oxidation, both as ex situ and in situ treatment, has been augmented to address the presence of 1,4-dioxane in groundwater.

4.1 STRATEGY FOR FULL-SCALE SYSTEM DESIGN

The lessons-learned from the ISCO and reductive dechlorination pilot studies (Section 2.7) provided a road map for full-scale application of these technologies at the Site. After the system operating parameters were optimized, the ozone/peroxide pilot-scale system was successful in achieving the test objectives of evaluating system performance and reducing COC concentrations without significant rebound. The reductive dechlorination (using HRC) pilot test also was successful in reducing VOC concentrations (but not 1,4-dioxane) in the pilot test area. Based on these observations, the following design strategy was developed for the full-scale groundwater remedial system:

- The in situ oxidation system will include the capability to inject both ozone and hydrogen peroxide. However, operation of the system could begin with injection of ozone only and transition to combined injection of hydrogen peroxide and ozone at less than stoichiometric mole to mole ratio of peroxide to ozone.
- It is possible, though not practical or cost-effective, to attain MCLs for all Site COCs across the entire groundwater plume using ISCO alone. However, it is both practical and cost-effective to use ISCO in the limited confines of the source area plume. As COC concentrations approach MCLs, the oxidation reaction kinetics is expected to be slower than that observed in the pilot study. Therefore, the ISCO system is designed to address COC concentrations greater than 50 µg/L. The portions of the plume less than the design concentration but greater than MCLs will be addressed with groundwater extraction and upgradient injection (in the source area), as well as the downgradient containment and treatment system (as per the ROD).
- Consistent with the ROD selected remedy, the downgradient containment and treatment system will include the following components: (1) enhanced reductive dechlorination with an injected carbon substrate, in the form of a permeable bioremediation barrier, to reduce VOC concentrations and shorten the time to reach cleanup goals; (2) groundwater extraction wells at the leading edge of the 5 ppb combined contaminant plume and downgradient of the bioremediation barrier, to contain the plume with residual VOCs and 1,4-dioxane at levels exceeding cleanup goals; (3) aboveground treatment, as needed, of the extracted groundwater; and (4) discharge of the treated water to the sanitary sewer under an LACSD permit.

4.2 OU1 REMEDIAL DESIGN

4.2.1 Source Area Strategy

The primary remedial alternative designed to reduce COC concentrations to cleanup levels is the use of ISCO, in conjunction with groundwater extraction, treatment and re-injection. Ozone will be used as the primary oxidant during the ISCO activities. Hydrogen peroxide may also be used as a co-oxidant depending on Site conditions and the results of the ozone-only injection. The remediation equipment will be capable of injecting both the oxidants.

Oxidant injection wells will be installed in the source area (which for design purposes is represented by the composite 100 ppb concentration contour of TCE; cis-1,2-DCE; and 1,4-dioxane), forming a permeable V-shaped barrier to the groundwater. The ozone and hydrogen peroxide will be supplied via a commercially available in situ chemical oxidation system. Additional components of the OU1 source area strategy will include the following.

- Extraction of groundwater downgradient of the ISCO barrier.
- Aboveground treatment and injection of this extracted groundwater upgradient of the ISCO barrier.

As indicated in the flow modeling results on Figure 4-1, the extraction well, installed downgradient of the ISCO barrier, will provide hydraulic control in the source area and maximize groundwater flow through the permeable barrier. Additionally, use of groundwater extraction followed by injection upgradient may also help in shortening of the cleanup time as per flow modeling results (Appendix F).

4.2.2 Remedial Design for Source Area Groundwater

The design details the ozone/ hydrogen peroxide (henceforth referred to as peroxone) well, extraction well, and injection well locations and also the depth of the screen intervals in each case. Three existing peroxone injection wells, M_{ox}-1, M_{ox}-2, and M_{ox}-3, were installed on Site for the pilot study evaluation and will also be utilized as part of the design. The existing peroxone injection wells were installed 35 feet to 50 feet apart from one another for maximum overlap of individual well radii of influence (ROIs).

Twelve new peroxone wells, denoted P_{ox}-1 through P_{ox}-12, will be installed in the source area, to approximately 70 to 95 feet bgs. The oxidant injection depths will be 10 feet below the target groundwater contamination; however, the actual screen depth interval will depend on location-specific lithology. Consistent with the maximum injection well spacing during the ISCO pilot test, the ROI of the peroxone injection wells is conservatively estimated to be around 25 feet. Based on this estimate, the new peroxone wells will be placed approximately 50 feet from each other, depending on actual Site conditions. The peroxone injection wells will be installed in a "double V" or triangular-shaped pattern intersecting the groundwater flow direction and will mainly target the northern portion of the source contamination area close to the former HWA (with 100 ppb or greater levels of COC contamination). The OU1 Source Area Design is shown on Sheet C-1 of the design drawings, included as a separate tab to Volume I of this report.

ISCO system operation is anticipated to continue for three years, after which the capture and treatment of the residual COCs in groundwater will be addressed by the extraction/treatment system. The ISCO remediation equipment will be housed in a closed warehouse located along Rayo Avenue, adjacent to the treatment compound (Figure 4-2).

The total depth of the source area extraction well will be approximately 105 feet bgs. The well will be screened from 60 to 100 feet bgs. In addition, there will be a 5-foot deep sump bringing the total depth to 105 feet bgs. The placement of the extraction well will be geared toward capture of the 10 µg/L isoconcentration contour for 1,4-dioxane and any portions of the source area plume that lie beyond the ISCO system area of influence (Figure 4-1). The design flow rate of the extraction well will be 25 gpm, which based on the modeling results will capture most of the 10 µg/L 1,4-dioxane plume without commingling of off-site plumes.

The total depth of each of the two injection wells will be 85 feet bgs. The injection wells (located upgradient of the ISCO barrier, as shown on Figures 4-1 and 4-2) will be screened from 55 to 85 feet bgs. MODFLOW simulations supported the notion that injection would reduce the time to reach cleanup goals by increasing the groundwater flow rates in the treatment area. This is particularly valid in situations where thick sandy layers dominate the aquifer lithology, although the same may not be true in areas where tighter lithologies are present. The subsurface lithology at the Site is dominated by sandy layers that gradually thicken downgradient of the source area. Hence, injection upgradient of source area is expected to be successful in expediting the remediation of COCs. Based on modeling results, the two injection wells will be able to handle 30 gpm: 25 gpm from the source area extraction wells, and 5 gpm from the dewatering of the perched aquifer (as part of the OU2 soil RA).

The injection and extraction well trenching details and well construction details can be found on Sheets C-3 and C-6, respectively, of the design drawings. The design calculations for the pressure losses and the groundwater conveyance pipe sizes are included as Appendix I, Volume II, of this report.

Extracted groundwater will be treated aboveground in a VOC and 1,4-dioxane advanced oxidation process unit that will also be used for cleanup of the perched aquifer groundwater as part of OU2 RA. A liquid-phase granular activated carbon (LGAC) unit also will be used as required, to further polish the treated water. The current design assumes that ISCO in the source area will cease after 3 years of operation. However, operation of the source area extraction well and the aboveground treatment of the extracted water could continue even after ISCO is stopped. The groundwater treatment compound plan is depicted on Sheet S-1 of the design drawings, which are presented under a separate tab in Volume I of this report.

4.2.3 Downgradient Containment and Treatment Strategy

The downgradient containment and treatment strategy includes extraction of groundwater at the leading edge of the impacted groundwater plume and the use of an in situ permeable bioremediation barrier to expedite remediation of a portion of the plume between the source area system and the downgradient containment and treatment system. The use of in situ bioremediation will enhance the ongoing reductive dechlorination of VOCs in groundwater.

The current design includes conveyance of the extracted groundwater back up to the groundwater treatment plant located on site, followed by treatment and discharge to the sanitary sewer location on site, under an LACSD waste discharge permit. However, a final determination as to whether the extracted water will require treatment cannot be made until groundwater extraction wells have been installed, tested, and sampled prior to implementation of the RA.

The groundwater flow modeling results on Figure 4-3 show that groundwater extraction along McCallum Avenue could be designed to minimize the impact of adjacent plumes, while also providing hydraulic control of the groundwater through the permeable bioremediation barrier. The combined effect would be to further enhance/accelerate the treatment of Site groundwater and to reduce the time until cleanup goals are reached. Installation of a permeable bioremediation barrier along Southern Avenue would reduce the targeted treatment area for pump and treat to the area between Southern and McCallum Avenues. As mid-plume COC concentrations are biodegraded along Southern Avenue, the results of the HRC pilot test and analytical pore volume modeling indicate that the required operation time of the extraction wells could be significantly reduced. The downgradient strategy is depicted on Figure 4-3 and on design drawings.

4.2.4 Remedial Design for Downgradient Containment and Treatment of Groundwater

To provide plume containment, the RA will include the installation of two groundwater extraction wells at the leading edge of the 5 µg/L plume downgradient of the source area near McCallum Avenue. Results from a recent CPT/HydroPunch investigation (Section 2.4) indicate that the leading edge of the groundwater plume may be slightly south of McCallum Avenue (Figure 2-2). The downgradient extraction wells will be installed to a total depth of about 115 feet bgs. The wells will be screened from approximately 65 to 112 feet bgs. Each well will pump groundwater at a flow rate of approximately 20 gpm. (For typical extraction well design, see Sheet C-6.)

In addition to groundwater extraction, a 350-foot long barrier of an injected reductive dechlorination enhancing substrate will be placed along Southern Avenue (see Sheet C-2 of the design drawings). The substrate will be injected via borings drilled down to approximately 100 feet bgs. The substrate injection depth interval will be from approximately 80 to 100 feet bgs. Groundwater extraction along McCallum will be designed to minimize the impact of adjacent plumes, while also providing hydraulic control of the groundwater through the permeable bioremediation barrier. The combined effect will be to further enhance/accelerate Site groundwater treatment and to reduce the time until cleanup goals are reached. With the addition of the permeable bioremediation barrier, results of the previous HRC pilot test and analytical pore volume modeling indicate that the required operation time of the extraction wells could be significantly reduced, possibly from upwards of 35 years down to 20 years or less. Groundwater monitoring results from wells along Southern Avenue have shown the presence of TCE biodegradation daughter products (cis-1,2-DCE and VC), and negative ORP levels, suggesting that aquifer conditions in the downgradient area are conducive to reductive dechlorination.

In the current design, extracted groundwater is conveyed back up to the groundwater treatment plant located on site (see Sheet C-2 for more detail). Since the groundwater extracted in the downgradient area will flow through a reductive dechlorination bioremediation barrier, it is anticipated that residual 1,4-dioxane concentrations persisting in the groundwater may not be treated effectively by the bioremediation barrier (as shown in the HRC field scale pilot study). In order to attenuate the 1,4-dioxane levels to below cleanup levels, if needed, the advanced oxidation groundwater treatment unit will be used to also treat the groundwater extracted from the leading edge of the Cooper Drum plume. Use of this unit is expected to ensure compliance of all Site VOCs and SVOCs with discharge levels. Additionally, the LGAC vessels will be used to treat any residual/trace VOCs. However, a final determination as to whether treatment of this water will be required cannot be made until results are available from additional samples to be collected during implementation of the RA.

The source area injection wells have adequate capacity to handle the 30 gpm extracted from the perched aquifer and from the source area plume but they cannot handle the additional water (approximately 40 gpm) extracted from the leading edge of the plume. Therefore, extracted and treated water in excess of 30 gpm will be discharged to the sanitary sewer discharge point located on site, under an LACSD waste discharge permit.

A detailed inventory of all the equipment necessary for the groundwater design and the costs involved are included as part of the engineering costs summary, which are provided under a separate tab in this volume (Volume I) of the report. Design drawings also are provided in this volume of the report.

4.2.5 Groundwater Extraction Well Placement and Zone of Capture

One groundwater extraction well will be installed downgradient of the source area (east side of Rayo Avenue near MW-15) to address parts of the groundwater plume where contaminant concentrations are less than the ISCO design concentration, but greater than cleanup levels.

Placement of the downgradient extraction wells, as determined based on flow modeling results and existing Site geology, will be along McCallum Avenue, downgradient of the permeable bioremediation barrier. The complete modeling results are documented in the *OU1 Groundwater Remedy Conceptual Design* (URS, 2007d). A description of the groundwater model and sample modeling results are also included as Appendix F, Volume II, of this report.

Extracted groundwater will be treated in the above-ground treatment system located on site (which will also treat extracted perched groundwater as detailed in the soil RA) prior to being discharged. Discharge of water will be either via injection into two injection wells to be installed upgradient of the source area, or via the sanitary sewer discharge point located on site.

4.2.6 ISCO Radius of Influence

During the ISCO pilot study, the ROI of each oxidant injection well was conservatively assumed to be in the range 10 to 25 feet. The distance between the monitoring wells and the injection locations was therefore, varied (i.e., 10, 15, 20, and 30 feet) in order to evaluate the ROI of the injection wells.

DO and ORP measurements collected during the pilot study using downhole and flow-through cell devices confirmed that the injection well ROI was at least 30 feet (i.e., the largest distance between an injection well and a monitoring well). Additionally, a greater ROI was recorded in the upper injection interval in the shallow aquifer (approximately 50 to 80 feet bgs). This is probably due to the presence of less permeable aquifer material in the 40- to 50-foot bgs interval. Therefore, the maximum spacing between injection wells will be 50 feet (corresponding to a minimum ROI of 25 feet).

4.2.7 ISCO Injection Depth

During the ISCO pilot study, DO and ORP measurements were collected at 5-foot intervals in the wells. Given the short screen intervals in MW-20B (10 feet) and MW-33B (10 feet), the measurements did not reflect a significant change in DO or ORP as a function of depth in these monitor wells. However, the shallow wells (MW-20 and MW-33A) did show increased levels of ORP and DO in the 50- to 55-foot depth interval versus the 60- to 65-foot depth interval in which the oxidants were injected. This was expected based on the pressure buildup in MW-20 and MW-33A, which was caused by the presence of the semi-confining layer just above 50 feet bgs.

Significant information was collected from EW-1, which has a 40-foot screen interval. For three of the five profiling events conducted during the focused injection, a significant increase in ORP (up to 230 millivolts [mV]) and DO (up to 5.2 milligrams per liter [mg/L]) was measured at the 80-foot depth interval (as compared to the deeper interval down to 85 feet bgs), suggesting the vertical offset of the influence of the deeper ISCO injection at 85 feet bgs was 10 feet or less at this location.

Therefore, the results of vertical profiling indicate that, for optimal results, the injection interval should be a maximum of 10 feet below the remediation target area. This is likely due to the cone-like diffusion pattern of the injected ozone/ hydrogen peroxide and air.

4.2.8 Ozone/Hydrogen Peroxide Injection Well Details

The peroxone injection wells will be installed in 10-inch diameter soil borings. The wells will be installed with the following components: two hydrogen peroxide and two ozone injection risers, each completed with 0.02-inch, V-slotted, 1 to 3-foot length screens, within 0.5-inch outer diameter (OD) stainless steel tubing, and check valves to prevent backpressure into the injection lines. The ozone and hydrogen peroxide risers and screens for each depth range will be provided in a pre-fabricated assembly. The deeper injection assembly will be installed with the ozone screen down to approximately 95 feet bgs, 5 feet above the bottom of the injection well boring. (Screen placement will depend on location-specific lithology and actual screen intervals may vary from those specified in this report. The final screen intervals are likely to be determined by the field geologist during installation.) A Monterey No. 3 sand filter pack will be placed surrounding the screen to 1.5 feet above the top of the screen. A 2-foot bentonite seal will then be placed above the sand pack surrounding the 1-foot-long ozone screen, to prevent short-circuiting. The 3-foot-long hydrogen peroxide screen will be positioned above the bentonite seal section. Sand pack will then placed surrounding the hydrogen peroxide screen and to a depth of 2 feet above the top of the screen. The borehole will then be sealed with bentonite up to 78 feet bgs, where another injection unit (the shallow injection assembly) will be placed in the borehole and installed as described for the deeper unit. Following installation of the prefabricated assembly and tubing, each borehole will be filled to the top with grout or bentonite and then completed with a protective, lockable access vault.

Following the injection well installations, trenching will be performed, and the conveyance piping/tubing will be installed from the well vaults to the ISCO trailers. Tubing will be used for delivery of ozone and hydrogen peroxide as per manufacturer recommendations. Teflon tubing contained in an outer polyethylene sleeve is commonly used to convey ozone. Polyvinyl chloride (PVC) tubing is used to convey hydrogen peroxide. All tubing from the injection wells to the ISCO trailers will be bundled and contained in 4-inch Schedule 40 PVC piping.

4.2.9 In Situ Ozone and Hydrogen Peroxide Injection

The benefits of ISCO are two fold: apart from destruction of the COCs that come into contact with the injected oxidants, ISCO processes also increase DO levels in the aquifer and have been shown to stimulate in situ biological activity. In some cases, ISCO has been used to oxidize arsenic, which has been detected in the Site vadose zone during past sampling events. Arsenic is less soluble at its highest oxidation state. Thus, use of ISCO may be beneficial in addressing any existing arsenic contamination at the Site.

The ozone/hydrogen peroxide delivery equipment will be provided by a commercial vendor. It will consist of a trailer-mounted chemical oxidation system, which will direct appropriate flow rates of ozone and hydrogen peroxide into peroxone wells fitted with pre-fabricated injection assemblies, as described above. The system is expected to remediate both adsorbed and dissolved-phase organic compounds.

The trailer system will be set up to inject individual or variable combinations of air, oxygen, ozone, and hydrogen peroxide into the saturated zone. ISCO system specifications are determined based on the pilot-scale study results. Each trailer-mounted ozone system will have the capability to deliver up to 130 pounds per day of up to 95% oxygen, which will be sufficient for the ozone generator to produce up to 15 pounds per day of ozone. The system will be designed for ozone injection rates of 2 pounds per day per injection well (or 1 pound per day per injection interval). This rate, when implemented during the last six weeks of the pilot test, showed the highest rate of COC destruction. It is not known whether higher oxidant injection rates would be beneficial; therefore, the design will allow for modification of the ozone injection rate, pending observed system performance.

At the estimated design rate of 2 pounds per day of ozone per injection well, for 15 injection wells, two such systems would be required to provide adequate ozone. A standard chemical feed pump will deliver the hydrogen peroxide from a tank storing approximately 150 gallons of up to 35% strength hydrogen peroxide. An air compressor with a port gas delivery manifold will provide up to 18 scfm of compressed air at 120 pounds per square inch (psi). The trailer-mounted ISCO delivery system will include a 24-port gas/chemical delivery manifold with 0.25-inch stainless steel solenoid valves for pulsing oxygen, air, ozone, and/or hydrogen peroxide into the injection wells. The injection process will be controlled through an integrated programmable logic controller (PLC) system that controls valve sequencing and activates all audio/visual alarms. A call-out modem will be included for reporting the system operational status.

4.2.10 Downgradient Containment and Treatment System

The presence of a permeable bioremediation barrier in the downgradient area is expected to reduce the required operation time of the downgradient extraction wells (DEW-1 and DEW-2) by as much as 15 years, according to analytical pore modeling results. The VOC concentrations are expected to meet the action levels. Since 1,4-dioxane is not degraded by the bioremediation barrier (as demonstrated in the HRC field-scale study), the current plan is to use an ex situ groundwater treatment unit, employing advanced oxidative treatment, to treat the 1,4-dioxane and residual VOCs, if needed.. However, a final determination as to whether pretreatment of the extracted water prior to discharge will be necessary can only be made when the two groundwater extraction wells (DEW-1 and DEW-2) and the proposed new monitor well are installed and sampled as part of the RA implementation.

To summarize, the current downgradient system design consists of two downgradient extraction wells near McCallum Avenue, the 350-foot permeable bioremediation barrier along Southern Avenue, and the piping from the extraction wells up to the location of the source area extraction well, where the piping will be plumbed into the pipeline that then continues from the source area extraction well to the on-site treatment compound (see Sheets C-1 and C-2 for detail).

4.2.11 Manifold and Piping Design

The manifold and piping design for the groundwater remedy account for these unique systems: a groundwater extraction and two groundwater injection wells located in the source area, two groundwater extraction wells located in the downgradient edge of the groundwater plume, an in situ ozone and hydrogen peroxide injection system, and an ex situ advanced oxidation and GAC system. Each of these systems require special considerations for manifold design, piping material, and conveyance layout.

Both the source area and downgradient groundwater extraction/injection systems will have flow control valves, check valves, flow meters, and a tee which will allow for sampling and flow pressure measurements inside the well vault. The downgradient wells will tie-in underground and flow back towards the treatment system. As the conveyance line flows near the source area extraction system, the flows will combine and be directed back to the ex situ advanced oxidation system in one pipe. As the flow from each well is individually connected, no aboveground manifold will be required. The piping material for these groundwater extraction systems will be high density polyethylene (HDPE). This material is much stronger than PVC, has less friction losses because of fewer fittings required for installation, and can be installed much quicker than a PVC pipeline. The piping diameters will be a minimum of 2 inches and will match the inlet and outlet diameter of the treatment system to avoid any unnecessary contractions which would require a larger pump to overcome the resulting friction losses.

The extracted groundwater will pass through an ex situ treatment system for treatment consisting of an advanced oxidation system and two LGAC vessels. The advanced oxidation system is a self-contained system utilizing hydrogen peroxide and ozone to destroy contaminants. Any manifolds and piping for this system will be provided as an integral piece of the system. However, all equipment downstream of the unit will need to be compatible with ozone and hydrogen peroxide for any residual hydrogen peroxide or ozone not consumed in the advanced oxidation system reactor. Teflon inner tubing contained within a polyethylene sleeve, or other manufacturer-approved material, would be appropriate for ozone conveyance. Chlorinated PVC (CPVC), PVC, or other manufacturer-approved material, would be appropriate for hydrogen peroxide conveyance. The LGAC vessels will not require any manifold other than valves to isolate the vessels for operation and maintenance (O&M) activities. The LGAC vessels will be placed in series and will be connected by hoses to allow for simple O&M, switching of vessels from lead to lag following changeouts of spent carbon, and sample ports to monitor breakthrough at each vessel.

The in situ hydrogen peroxide and ozone system manifold is provided by the manufacturer as part of the complete system. The manifold will be fairly complex, consisting of solenoids or actuated valves controlled by a PLC rotating injection points at pre-set time intervals. The manifold will be located inside the treatment system, typically a panel or trailer. The manifold equipment will comprise of materials compatible with hydrogen peroxide and/or ozone. A PVC conduit will typically be required for these tubing materials for underground installation, as they cannot be direct-buried. The tubing is typically Teflon contained within a polyethylene outer sleeve for ozone, PVC for hydrogen peroxide, and/or other manufacturer-approved materials. The outer sleeves or conduits would be approximately ½-inch to 1-inch in diameter. The riser pipes inside the ozone/peroxide injection wells are typically made of ½-inch stainless steel tubing. All piping sizes and materials will require manufacturer approval.

4.3 PERFORMANCE SAMPLING ASSUMPTIONS

Sampling is required to monitor the performance of the source area treatment system. The following assumptions are made regarding treatment system performance and compliance monitoring.

4.3.1 Performance and Compliance Monitoring

System and well samples will be required during the system startup and routine operation to ensure proper operation of the remediation equipment and to evaluate if cleanup goals have been reached. A detailed summary of a typical sampling schedule is tabulated in Tables 4-1 and 4-2, respectively, for performance monitoring of the well network and the treatment system itself.

The frequency and parameters suggested in Table 4-1 are typical for ISCO/bioremediation/groundwater treatment systems. This table also lists the monitor wells that are likely to require monitoring during the various stages of the RA.

Initially all groundwater monitoring wells will be sampled quarterly. As concentrations decline, the sampling frequency is expected to decline as follows:

- Quarterly – groundwater concentrations greater than cleanup goals;
- Semiannual – groundwater concentrations less than cleanup goals during the previous sample event;
- Annual – groundwater concentrations less than cleanup goals for two consecutive sample events; and
- Confirmation sampling if groundwater concentrations remain less than cleanup goals for three consecutive sample events.

If concentrations increase above cleanup goals at any time, the well shall resume the quarterly sampling frequency and follow the process listed above.

Table 4-2 lists the frequency of monitoring for the groundwater treatment system and extraction and injection wells. As shown in this table, more frequent sampling is expected during the first 4 weeks of operation.

The substantive requirements of the WDR permits and LACSD permit (for downgradient discharge) will determine the actual sampling frequencies, parameters, and analytical methods.

4.3.2 Post-Remediation Confirmation Compliance Monitoring

The RD assumes that the source area ISCO system will operate for approximately 3 years. However, this system may be turned off earlier if RA targets are met ahead of schedule. This shutdown will allow for any potential rebound to occur. During this time, quarterly well sampling events for a period of up to 1 year will confirm if concentrations have rebounded to levels above the RA goals. The confirmation sampling will include at least one sample from the source area extraction well and all monitoring wells within the in situ oxidation area. If results show evidence of rebound, a decision will have to be made to restart oxidation, or to allow the aboveground treatment system to treat the residual source area contamination. If concentrations are still below cleanup levels, the source area treatment system will be recommended for shut down.

Once contaminant concentrations across the Site plume have reached target cleanup levels, the groundwater treatment system will be turned off. This shutdown will allow for any potential rebound in the Gaspur Aquifer to occur. During this time, well sampling events, as listed in Table 4-1, will be conducted for up to 3 years, to confirm whether the site is clean or concentrations have rebounded to levels above the cleanup goals. If results show evidence of rebound the system will be restarted. If concentrations remain below target cleanup levels, the Site will be recommended for closure sampling which would include sampling of every monitor and extraction well.

4.4 TREATMENT SYSTEMS MONITORING

The ISCO and aboveground treatment systems will typically include the following components to promote safe and efficient remediation operations. Actual instrumentation will vary depending on the specific vendor supplying a given system.

- Source Area ISCO System:
  - *Oxygen and Ozone Pressure Gauges* on each vapor inflow line and on the manifold headers.
  - *Ozone Pressure Regulator, Ozone Injector Pressure Gauge, Oxygen Flow Switch, and Lower Explosive Limit (LEL) meter.* Ozone and oxygen pressure monitoring is required to regulate the amount of oxygen (and subsequently ozone) being delivered to the 15 online wells.
  - *Flow Rates* monitored via *flow meters* on each line. If the flow rates fall outside of the operating limits, headers may be blocked or plugged.
  - *Temperature Switches* and *Temperature Gauges* to monitor for safe operation. When temperatures exceed the high-temperature set point, a system shutdown will be triggered.
  - *Pressure Switches* on the inlet and outlet side of the ozone compressor. If pressures fall outside of the operating limits, the structural integrity of the pipe/equipment may be exceeded, triggering a system shutdown.
  - *An Hour Meter* to document system performance. It also will communicate to the controller so that the system can be monitored remotely to verify operation.
  - *Tank Float Switches* in the hydrogen peroxide holding tank and the influent groundwater holding tank to monitor for liquid level. These switches monitor the low level, high level, and high/high level in the tanks. These level controls are used with the controller to call for more flow or to stop the flow from the holding tank.

- Aboveground Groundwater Treatment System:
  - *Advanced Oxidation System*
    - *Ozone Pressure Gauges and Check Valves, Automatic Pressure Control and Shutoff Valve* located on the rack-mounted, solid-state ozone generator and ozone manifold of the Oxygen Generation/Distribution System.
    - *Oxygen Flow Controller, which* is required to regulate the amount of oxygen being delivered to the Advanced Oxidation System.
    - *Tank Float Switches* in the hydrogen peroxide holding tank and ozone holding tank to monitor for liquid level. These switches monitor the low level, high level, and high/high level in the tanks. These level controls are used with the controller to call for more flow or to stop the flow from the holding tank.
    - *Inlet Flow Meter* to monitor flow through the advanced oxidation system.
  - *LGAC Unit*

    - *Pressure Switches* on the inlet, middle, and outlet groundwater conveyance line of the LGAC Vessels. If pressures fall outside of the operating limits, there may be a blockage in the groundwater line, triggering a system shutdown.
- *Flow Metes* on the effluent/groundwater re-injection line. If the flow rates fall below the operating limits, may cause cavitation and ruin the groundwater injection pumps, and if above operating limits, water may begin to back-flow, causing a system shutdown.
- *Flow Meter/Totalizer* at the discharge location to monitor the total volume of groundwater discharged.

Controls associated with the treatment systems are typically installed on the system by the manufacturer as part of a typical controls package. A review of the manufacturer's controls will be conducted to ensure all parameters can be controlled such that the system will operate safely and continuously.

4.5 INSTRUMENTATION

The following instrumentation and process components are typical of what will be available on the groundwater remediation system:

- <u>Source Area ISCO System</u>
  - Pressure gauges for each oxidant injection well on the manifold
  - Ozone/peroxide compressor motor thermal overload switch
  - Pressure and temperature monitors on all oxidant injection well lines

- <u>Advanced Oxidation System</u>
  - Pressure gauges for ozone generation/distribution system on the manifold, and oxygen system
  - Ozone detector and destruct unit

- <u>Groundwater Treatment Compound</u>
  - High- and low-temperature shutoff at the treatment system
  - Flow meters on all liquid conveyance lines
  - Pressure Indicators on groundwater lines before the first LGAC vessel, in between both LGAC vessels, and after the second LGAC Vessel
  - Water flow totalizer and system run clocks
  - Localized control panels and central control panel for the submersible groundwater pumps

The remediation system operators also will have other portable monitoring equipment and tools for proper remote system adjustment and operation.

4.6 ELECTRICAL CONTROLS

Electrical equipment will be designed and selected in accordance with the classification of the various areas of the remediation system. In accordance with the National Electrical Code (NEC), and considering the mixture of vapors the system will handle at the Site, the system is assumed to require Class 1, Division 1, electrical components, especially given that the system will be monitored and managed by operating personnel intermittently (after the initial startup). Class 1, Division 1-specified components are designed to operate in atmospheres with potentially explosive or flammable vapors.

System motors will be specified to be totally enclosed, fan-cooled (TEFC), as well as explosion-proof. The motors also will be rated "T," as defined by the NEC, and comply with the National Fire Protection Association (NFPA) 497M (or latest equivalent) to produce lower temperatures on the external housing, to comply with the Class 1, Division 1, criteria. Other electrical components will be specified to operate under outdoor weather conditions for this area. The electrical panel will include all overcurrent protection devices and motor starters as shown on the electrical design drawings (Sheets E-1, E-2, and E-3 of the design drawing package, which is included as a separate attachment to this report). There will be an emergency shut-off switch inside the compound and a system shut-off button on the supervisory control and data acquisition (SCADA) system. The remediation system will be lighted at night for security and safety.

The SCADA system is the central part of the control and automatic data collection systems. It consists of software systems and algorithms used to provide instructions to the plant automation equipment, such as PLC. The SCADA system will be specifically configured to communicate with each well control panel PLC and the main control panel PLC to provide direct control of the data collection system.

4.7 PROCESS SAFETY CHECKLIST

In addition to the mechanical controls mentioned above, which provide safe operation, the system design requires that the remediation system include the following key process safety features. Additional general O&M guidelines are provided as Appendix H of this report.

- O&M manual(s) for pertinent equipment;
- A clearly marked emergency shut-off switch in the treatment compound area;
- Security fencing and lighting;
- NFPA warning signs and placards on the security fence;
- Emergency contact names and phone numbers on the security fence;
- Spill prevention and containment cabinet;
- First aid kit;
- Clearly marked directional flow arrows on the process piping;
- Fire extinguisher; and
- Other safety components, as required.

A process safety review will be accomplished as an expanded component of the quality assurance (QA) review.

The deliverable product resulting from this effort will be a checklist that demonstrates compliance with ARARs and pertinent codes and standards for the project remediation system. This checklist will be a living document that follows the development of the design to the "final" stage and into system installation. It is currently anticipated that approximately one page of text may be incorporated into the process flow diagram (PFD) to record the revision number, date, and initials of the reviewing engineer.

4.8 DESIGN ASSUMPTIONS FOR GROUNDWATER TREATMENT

All design assumptions for the groundwater RA are shown in Table 4-3.

The overall treatment process, as described in the preceding sections, is a combination of in situ ozone and hydrogen peroxide injection with groundwater extraction/injection in the source area, and in situ bioremediation combined with groundwater plume containment and treatment in the downgradient area. For ease of access, the treatment compound will be located on-site (see Sheet C-1). The same treatment compound will be used to treat groundwater from the perched and Gaspur Aquifers. This compound also will hold the equipment for the soil RA (see Sheets P-2 and S-1 for detailed drawings). The treatment compound will be capable of injecting 30 gallons per minute (gpm) of treated groundwater through the injection wells. It will also be capable of discharging an additional 40 gpm to the sanitary sewer location on site. The total extracted water, estimated at 70 gpm, will comprise of the following: 5 gpm from the perched aquifer via the soil RA, 25 gpm from the source area extraction well, and 40 gpm from the two downgradient extraction well.

4.8.1 Media, Byproducts, and Process Rates

The ISCO in the source area will not produce byproducts. Because of the use of in situ technology, the extracted groundwater is anticipated to have relatively low COC concentrations. The extracted groundwater will be plumbed to the on-site treatment compound and will be treated aboveground via a commercially available advanced oxidation unit and a LGAC unit. The byproducts from the groundwater treatment system will be treated water that meets the discharge requirements and spent liquid-phase granular activated carbon.

The design flow rate of groundwater extracted downgradient of the ISCO barrier is 25 gpm. Another 5 gpm is expected from dewatering of the perched aquifer. The anticipated total flow rate from the downgradient containment system is estimated at 40 gpm. The extracted and treated water will be discharged via two pathways: approximately 30 gpm will be injected into the Gaspur Aquifer upgradient of the ISCO barrier, and the remaining water will be discharged to sanitary sewer under a LACSD permit.

4.8.2 Waste Stream Qualities

Local Sanitary Sewer District

Discharge to the LACSD sanitary sewer has a maximum design rate of 40 gpm. The quality discharge limits for LACSD parameters including flow rates, temperature, pH, total dissolved solids (TDS), select metals, and organics (i.e., VOCs and 1,4-dioxane) will be monitored and controlled carefully. The trench details for sewer discharge sampling box are shown on Sheet C-4 of the design drawings.

Liquid-Phase Granular Activated Carbon

LGAC will be selected, handled and disposed with the assistance of a pre-qualified carbon vendor. The plant operators will supervise the carbon changeouts. After the change-out, the carbon vendor will perform the actual carbon removal and regeneration for future use, or disposal to a licensed landfill.

4.8.3 Performance Standards

Performance standards focus on the following objectives:

- Operator and personnel safety
- Process efficiency and zero health and safety (H&S) or environmental health and safety (EH&S) incidents
- Cost-effectiveness

Remediation system design will incorporate mechanical and electrical safeguards. Operator training, safety consciousness, and experience will be required for safe operation. The remediation system will include design flexibility to maximize process efficiency. Operator training, along with engineering technical services, will be required to meet the second objective of process efficiency with zero H&S incidents. Accomplishing the first two objectives listed above, along with maximizing run time, will help achieve the third objective, cost-effectiveness.

4.8.4 Long-Term Performance Monitoring

The system operators, with the help of the supervising engineers, will monitor long-term system performance. Key parameters, such as contaminant levels, discharge limitations, and system efficiency, will be tracked and monitored. Remedial process optimization (RPO) reviews will be implemented as necessary.

4.8.5 Project Quality Checklist, Pertinent Codes, and Standards

The Project Quality Checklist includes a section on Process Safety, ARARs, Pertinent Codes, and Standards. This checklist is a living document that will follow the development of the design to the "final" stage and into installation. The checklist is currently anticipated to consist of approximately one page of text that may be incorporated into the PFD engineering drawing. It will also record the revision number, date, and reviewing engineer initials.

4.8.6 Other Technical Factors

As other technical factors become apparent regarding the remediation system design or O&M, this RDR will be revised and recorded, as appropriate. Revisions to the RDR and/or engineering drawings must be approved by EPA Region 9.

5.0 CONSTRUCTION AND IMPLEMENTATION

5.1 PLANS

The following plans must be provided before implementation of the RA

The Remedial Action Work Plan (RAWP) identifies construction and implementation issues to be carried out by the remedial action contractor. The RAWP will include a Site Health and Safety Plan (HASP), Sampling and Analysis Plant (SAP), and the Construction Quality Control Plan (CQCP).

A generalized CQCP has been included as Appendix G (Volume II) of the RDR. The RAWP, HASP, and SAP will be prepared by the remedial action contractor. The CQCP is intended to establish project organization and includes requirements for independent evaluation of the construction conformance with the design specifications.

A Construction Completion Report will be prepared by the construction contractor that includes discussion of field design changes, as-builts, quality control results, and health and safety documentation.

A generalized O&M manual for the groundwater treatment system has been included as Appendix H (Volume II) of this RDR, however a more specific O&M manual, which includes system and vendor-specific guidelines must be provided by the construction contractor. The O&M manual will be provided in conjunction with the RAWP. The O&M manual will include: (1) a description of the treatment system operation; (2) a description of potential operating problems and solutions; (3) specifications and maintenance schedules for all equipment.

5.2 DESIGN DRAWINGS

A full set of design drawings are included in this volume of the RDR (Volume I). These design drawings for the RA have been previously referenced in prior sections of this report. Additionally, a full-sized set of drawings are attached.

5.3 SPECIFICATIONS

Complete specifications for the remedial action are provided in Volume III of this RDR and are intended to accompany the Drawings package for use in the field during construction.

5.4 SCHEDULE

A RA schedule also is included in this volume of the RDR (Volume I). The schedule includes both the OU1 groundwater and OU2 soil RA. Because a start date for the RA has not been determined, the schedule is based on days to complete each task following start of construction activities.

5.5 COST ESTIMATE

An RA cost estimate has been prepared based on the RD presented herein and is provided under a separate tab in this volume of the RDR (Volume I). The total estimated capital cost for the groundwater RA is approximately $2,220,000. This estimate assumes that construction of the RA occurs in the first year (i.e., capital costs are not inflated or discounted). The total present worth O&M cost is estimated at $3,810,000. This estimate accounts for inflation, as well as a discount rate of 7%, over the 23-year duration of the project (assuming that only confirmation monitoring will occur during the last 3 years). Based on these estimates of the capital and the present worth O&M costs, the total cost for implementation of the groundwater RA is approximately $6,030,000 in 2007 dollars.

The cost estimate was prepared using prior experience and actual subcontractor bids. The cost estimate is expected to be within plus 15 percent and minus 5 percent.

5.6 CONTRACTOR QUALIFICATIONS

The contractor shall have three to five years experience with soil and groundwater remediation systems, and piping systems. The contractor will be responsible for the quality performance of the work specified and preparation of products and reports as required for completion of installation of systems. The contractor will also manage all solid wastes generated during construction and trenching of the site including sampling and disposal of wastes. The contractor will provide technical and administrative services, monitor, supervise, review work performed, coordinate budgeting and scheduling to assure that the project is completed within budget, on schedule, and in accordance with approved procedures and applicable laws and regulations. All employees or subcontractors performing work on this site will be 40-hour trained under CFR 1910.120 and CCR title 8-5192. The contractor shall be bonded and licensed in the state of California, providing references and descriptions of previous related work. The contractor will identify the potential physical and chemical hazards that may be encountered; and will specify health and safety control measures to be implemented throughout the course of the project.

5.7 COOPER DRUM PROPERTY SITE ACCESS

The area of the Cooper Drum property where remediation equipment will be installed must be vacated and secured during the RA. This will enable safety and prevent exposure to hazardous substances during installation and operation of the remedial systems.

5.8 OFF-SITE EASEMENT AND ACCESS.

Since the Cooper Drum Site is bordered between Coryal Street and Rayo Avenue, with downgradiant extraction wells located on McCallum Avenue and additional monitoring wells to be located between Southern Avenue and McCallum Avenue, it is expected that the contractor will gain required permits, easements, and rights of way to access lands or public areas. The contractor will need to prepare traffic plans, and schedule traffic controls prior to the start of work, taking in consideration delays and restrictions in the work schedule to accommodate possible delays due to weather, traffic, easement and access restrictions.

6.0 ENVIRONMENTAL AND PUBLIC IMPACT REDUCTION PLAN

The overall remediation system will be designed and constructed with the objective of reducing environmental and public impacts. As stated in Section 4.9.3, Performance Standards, system operation objectives will be to achieve the following parameters.

- Operator and personnel safety
- Process efficiency with zero H&S or EH&S incidents
- Cost-effectiveness

These objectives will ensure little or no impact on the environment and the public. In addition, the remediation system will include security, electrical grounding, visual impact reduction, security fencing, and spill containment. Details of these additional environmental and public impact reduction plans follow.

6.1 SECURITY AND FENCING

Security features on the system include automatic alarm settings on the process equipment and corresponding automatic notification to the responsible system operators. In addition, the system will include dusk-to-dawn lighting and automatic electrical shut-offs, in the event vandals tamper with the equipment and cause an auto-trip alarm.

The treatment compound for the aboveground groundwater treatment unit and the soil RA will include 8-foot chain-link fencing with lockable gates for entry and exit and security slats that will block the view of the process equipment to reduce public curiosity (see Sheet C-5 for fence details). Additionally, the entire compound will be surrounded by painted bollards to prevent accidents caused by on-site traffic (see Sheet S-1).

The ISCO trailers will be housed inside an on-Site warehouse along Rayo Avenue, south of the former HWA. Since most of the trailers will be housed indoors, it is unlikely that the system will cause any public safety concerns. Nevertheless, all safety protocols will be in place to minimize risk.

6.2 ELECTRICAL GROUNDING

The remediation system will be designed and installed with electrical grounding to minimize the potential for operator electrocution. Electrical grounding is also required because this system will process impacted groundwater. Noise abatement features will be included on the key pieces of process equipment.

6.3 VISUAL SCREENING

Security fencing will be installed with colored slats in the chain-link for visual screening. This type of fencing is very durable, secure, and suitable for this type of application. The screening should reduce complaints regarding visual concerns from local residents. Additionally, painted (yellow) bollards will surround the treatment compound.

6.4 SPILL CONTAINMENT

The remediation system will be constructed with spill containment features. The containment sump will include a sump pump and an alarm feature that will be tied into an automatic interlock for system shutdown.

7.0 REFERENCES

PRIMA Environmental, 2005. *ISCO Using Ozone and Hydrogen Peroxide – Bench-Scale Study*.

United States Environmental Protection Agency (EPA), 2002. *Record of Decision, Cooper Drum Company, City of Southgate, California*.

URS Group, Inc. (URS), 2002. *Cooper Drum Remedial Investigation Feasibility Study Report*.

URS, 2005. *Final Results of HRC Field Pilot Study*. April.

URS, 2006a. *Remedial Design Technical Memorandum for Field Sampling Results*. July.

URS, 2006b. *Field Pilot Study of ISCO Using Ozone and Hydrogen Peroxide*. December.

URS, 2007a. *Soil Remedial Design Report Operable Unit 2 Cooper Drum Superfund Site*. September.

URS, 2007b. *Remedial Design Technical Memorandum for Field Sampling Results, Addendum No. 2 CPT/HydroPunch Sampling Results February/March 2007*. June.

URS, 2007c. *Remedial Design Technical Memorandum for Field Sampling Results, Addendum No. 1 Groundwater Monitoring Report August 2006*. March.

URS, 2007d. *OU1 Groundwater Remedy Conceptual Design, Cooper Drum Company Site, South Gate, CA*. May.

TABLES

TABLE 2-1

Groundwater Contaminants of Concern and Cleanup Levels
Cooper Drum Company Superfund Site, South Gate, CA

Medium	Contaminant of Concern	Cleanup Level (µg/L)	Basis for Cleanup Level
Groundwater (VOCs)	1,1-Dichloroethane (1,1-DCA)	5	MCL[a]
	1,1-Dichloroethene (1,1-DCE)	6	MCL
	1,2-Dichloroethane (1,2-DCA)	0.5	MCL
	1,2-Dichloropropane (1,2-DCP)	5	MCL
	1,2,3-Trichloropropane (1,2,3-TCP)	1	PQL[b]
	Benzene	1.0	MCL
	cis-1,2-Dichloroethene (cis-1,2-DCE)	6	MCL
	trans-1,2-Dichloroethene (trans-1,2-DCE)	10	MCL
	Tetrachloroethene (PCE)	5	MCL
	Trichloroethene (TCE)	5	MCL
	Vinyl chloride	0.5	MCL
Groundwater (SVOC)	1,4-Dioxane	6.1	PRG[c,d]

[a] MCLs from Title 22 California Code of Regulation Section 64431 and 64444, unless otherwise specified.
[b] No MCL established for 1,2,3-trichloropropane. The PQL was identified as a remedial goal.
[c] No MCL established for 1,4-dioxane. The concentration is for the ingestion of drinking water only and does not account for potential dermal and inhalation exposure. EPA has established a screening criterion for PRGs.
[d] Cleanup action level will be reassessed and any revisions will be incorporated into the remedial action.

EPA = United States Environmental Protection Agency
MCL = California primary maximum contaminant level
PQL = practical quantification limit
PRG = EPA preliminary remediation goal for drinking water
SVOC = semivolatile organic compound
VOC = volatile organic compound
µg/L = micrograms per liter

TABLE 4-1

Monitor Well Sampling Summary
Sampling Summary for OU1 Groundwater Monitor Well Programs

Program	Number of Wells	Monitor Well Location	Sample Frequency
ISCO Waste Discharge Requirements Permit[a]	10 monitor wells[b]	MW-2, EW-1 (63' & 85') EW-2 (63'&78'), MW-20, MW-20B, MW-21, MW-33A, MW-33B, MW-39A, MW-39B	Baseline and monthly for 6 months, quarterly for remaining 2.5 years
Bioremediation Permeable Barrier Waste Discharge Requirements Permit[c]	10 monitor wells[d]	MW-24, MW-25, MW-25B, MW-27, MW-28, MW-29, MW-30, MW31, MW-31B, MW-38A	Quarterly for 5 years
Long Term Performance Monitoring[e]	24 monitor wells quarterly; 8 wells annually	24 quarterly wells-EW-1, EW-2, MW-10, MW-15, MW-17 MW-20, MW-20B, MW-21, MW-22, MW-23, MW-24, MW-27, MW-28, MW-29, MW-30, MW-31, MW-31B, MW-34A, MW-34B, MW35A, MW-35B, MW36A, MW-36B,MW-39A; 8 annual wells MW-2, MW-3, MW-16, MW-18, MW-19, MW-26, MW-32, MW-33A	Quarterly/Semiannually/ Annually (up to 23 years or less)[f]

[a] Per Los Angeles Regional Water Quality Control Board (LARWQCB) Wastewater Discharge Requirements (WDR) permit analyzed quarterly for VOCs, 1,4-dioxane, chloride, nitrate, sulfate, bromide, alkalinity, TSS, TDS, TOC, cations, hexavalent chromium, priority pollutant metals. VOCs and 1,4 dioxane only for more frequent than quarterly sampling. Cations include barium, boron, calcium, iron, magnesium, manganese, potassium, and sodium. Priority pollutant metals and hexavalent chromium will be analyzed during the initial sampling round and annually thereafter. All sampling events will include field parameters (ferrous iron, pH, DO, ORP, temperature, turbidity, and conductivity).

[b] After three years some wells EW-1, EW-2, MW-20, MW-20B, MW-21, MW-39A will continue to be sampled under long term performance monitoring.

[c] Per LARWQCB permit analyzed quarterly for VOCs; 1,4-dioxane; chloride; nitrate; sulfate; bromide; alkalinity; TDS: TOC; sulfide; ethane/ methane; CO_2, VFAs (volatile fatty acids, not required by WDR); and cations (include calcium, iron, magnesium, manganese, potassium, and sodium); plus field parameters (see No. 1 above).

[d] After five years it is anticipated that only six wells (to be determined) will continue to be sampled under long term performance monitoring.

[e] Wells will be analyzed quarterly for VOCs; semiannually for 1,4-dioxane. Analysis for MNA parameters will be performed during the annual sampling event, and will include alkalinity chloride, nitrate, sulfate, sulfide, ethene/ethane/methane, and field parameters (see No. 1 above).

[f] Initially all groundwater monitoring wells will be sampled quarterly. As concentrations decline, the sampling frequency shall decline as follows:

- Quarterly – groundwater concentration greater than cleanup goals;
- Semiannual – groundwater concentrations less than cleanup goals during the previous sample event; or
- Annual – groundwater concentrations less than cleanup goal for two consecutive sample events.
- Stop sampling a well, until confirmation sampling, if groundwater concentrations less than cleanup goal for three consecutive sample events.
- If concentrations increase above cleanup goals at any time, the well shall resume the quarterly sampling frequency and follow the process listed above.

TABLE 4-2

Treatment System Sampling Summary
Sampling Summary for OU1 Groundwater Extraction and Treatment System Sampling

Program	Sample Location	Sample Frequency	
		Initial Operations[a]	Long-Term Operations
Source area Extraction Well and Injection wells[b]	SEW-1, IW-1, IW-2	Weekly	Quarterly for 3 years
Downgradient Containment Extraction Wells[c]	DEW-1 and DEW-2	Weekly	Quarterly for 20 years
Treatment System[d]	Influent and effluent; and intermediate locations	Weekly	Monthly for 20 years
Treatment System POTW[e]	Effluent to POTW[c,e]	N/A	Bi-monthly

[a] Initial operations typically last one to four weeks. During this time, the remediation process is being fine tuned to operate at maximum efficiency given the Site conditions.

[b] It is assumed that only one WDR permit will be required for the ISCO and groundwater injection wells (see Table 4-1). Injection wells and extraction wells will be sampled for the same parameters under the WDR permit for ISCO (see Table 4-1, footnote #1).

[c] Extraction wells will be sampled for the same parameters under the LARWQCB WDR permit for the bioremediation barrier (see Table 4-1, footnote #3).

[d] Treatment system influent and effluent analyzed for VOCs and 1,4-dioxane only. Two intermediate sample locations (prior to LGAC and between LGAC vessels) will be analyzed monthly for VOCs only.

[e] Per the Los Angeles County Sanitation District (LASCD), self-monitoring at the location of the discharge to the sewer lateral will be required as a permit condition. It is expected the permit requirement will require semimonthly sampling for chemical oxygen demand (COD) and suspend solids (SS), and quarterly for VOCs.

N/A = not applicable

TABLE 4-3

Design Assumptions for OU 1 (Groundwater Remedial Action)

Contaminants of Concern (COC): 1,2,3-TCP; TCE; 1,2-DCA; vinyl chloride; 1,2-DCP; 1,1-DCA; cis-1,2-DCE; PCE; trans-1,2-DCE; 1,1-DCE; benzene; and 1,4-dioxane.
Contaminant source area (i.e., 100 ppb plume) delineated during previous site investigations.
Site consists largely of sandy silts, silty sands, sand interspersed with minor layers of silts and clay.
Remedial Action includes installation of the following key elements.
Ozone/Hydrogen Peroxide (Peroxone) Injection Wells: – Number: 12 new and 3 existing wells. – Location: To be installed in the source area (i.e., 100 ppb plume) to form a double "V" shaped pattern in conjunction with the three existing peroxone injection wells. – Well design: Pre-fabricated injection assemblies, each completed with 1-inch outer diameter (OD) casing, 0.02-inch, V-slotted screens, 0.5-inch OD tubing, and check valves. – Total well depth: 100 ft bgs. – Injection intervals: 2 per location at 75 and 95 ft bgs (approximately). – Injection depth: 10 ft below the target groundwater contamination. – Radius of influence: 25 ft (minimum). – Oxidant: Ozone and hydrogen peroxide. – Ozone injection rate: Up do 2 lbs/day per injection well (<1.0 molar ratio of H_2O_2/O_3). – System design treatment concentration: > 50 µg/L.
Ozone/Hydrogen Peroxide Conduits: – 1-1/2" diameter PVC Schedule 40 conduit to contain 1 each 3/8" Teflon tubing and 1/4" polyethylene tubing. Notes: Teflon tubing for ozone; polyethylene tubing for hydrogen peroxide
In Situ Chemical Oxidation (ISCO) Trailers: – Number: 2 – Size: Approximately 21′ × 7′ – Location: Inside warehouse on site – Components: • ozone generation system—up to 15 lbs/day • oxygen generation system—up to 130 lbs/day (up to 95% concentration) • reagent distribution capacity—up to 10 ozone and 10 hydrogen peroxide injection points • hydrogen peroxide system—150-gal tank (up to 35% solution) 75 gal/day at 25 psig injection capacity • compressed air system—up to 120 psig pressure, up to 18 scfm injection capacity
Permeable Bioremediation Barrier: – Reductive dechlorination enhancing substrate. – Number injection points: 180. – Location: To be installed downgradient of the source area, along Southern Avenue. – Length of barrier: 350 ft. – Total boring depth: 100 ft bgs. – Injection intervals: 80 to 100 ft bgs. – Injection depth: 100 ft bgs (approximately).
Groundwater Extraction Wells: – Number: 3. – Location: One well to be installed downgradient of the source area to address groundwater containing contaminants at concentrations less than the ISCO design concentration (i.e., 50 µg/L) but greater than cleanup goals. Two wells to be installed downgradient near the 5 ppb plume boundary to contain the contaminant plume. – Total well depth: 105 ft bgs (for source area well); 115 ft bgs (for downgradient extraction wells). – Screen depth: 60 to 100 ft bgs for source area wells; 65 to 112 ft bgs for downgradient wells. – Extraction Rate: 25 gpm for source area; 20 gpm each for downgradient wells.

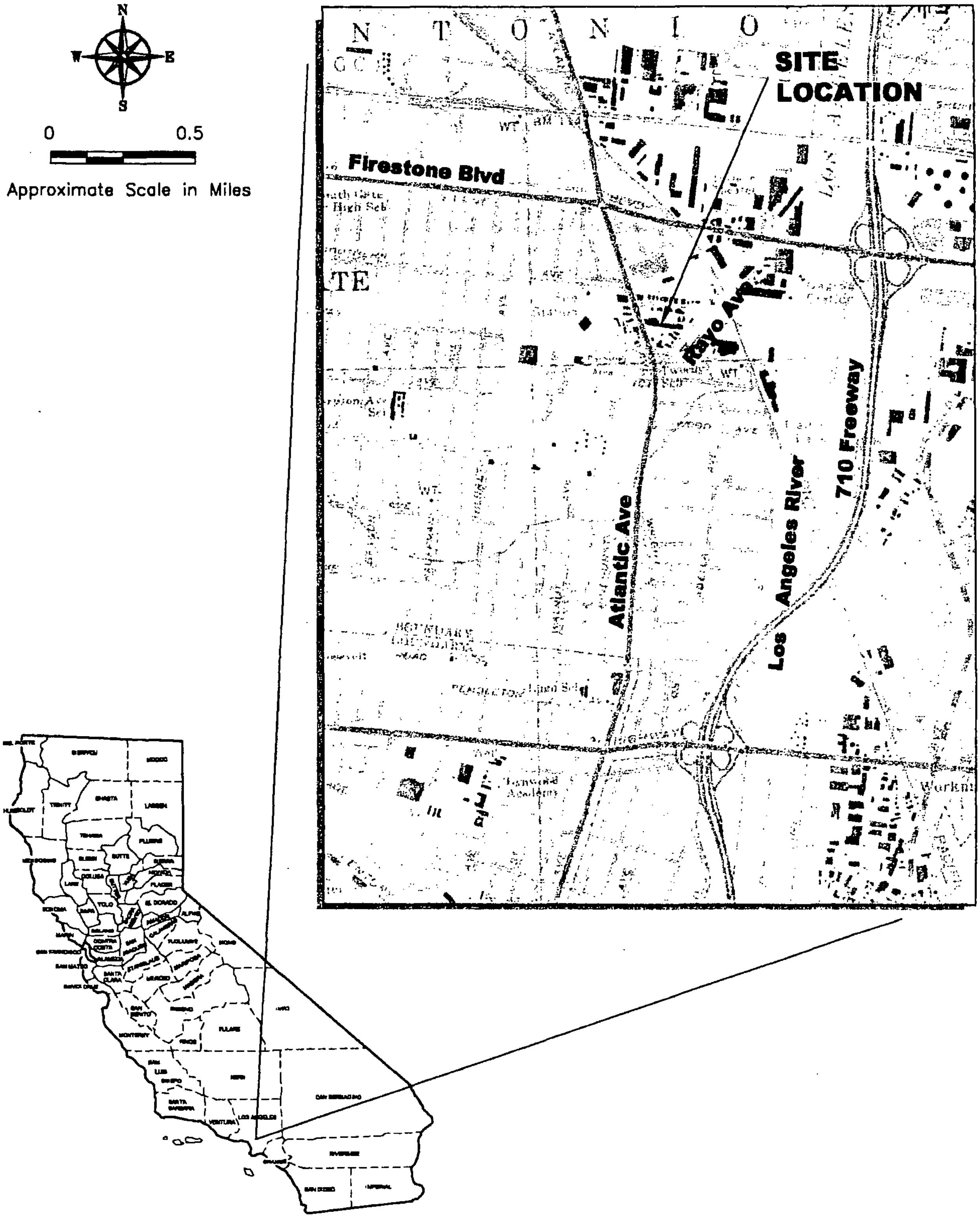
TABLE 4-3

(Continued)

Groundwater Injection Wells: – Number: 2. – Location: To be installed upgradient of the Peroxone Injection Well field. – Total well depth: 90 ft bgs. – Injection depth: 55 to 85 ft. – Groundwater injection rate: 15 gpm each.
Groundwater Extraction and Injection Well Piping: – Piping diameter: 2" HDPE SDR-11. – Length of pipe: Approximately 1,800′ (extraction wells) and 600′ (injection wells). – Buried at a depth of 2′ in sand layer, with magnetic tape.
Groundwater Treatment System: – Location: On site, next to warehouse. – Components: (a) Ex situ advanced oxidation process (also to be used for cleanup of perched aquifer groundwater as part of soil remedial action) and (b) two liquid-phase granular activated carbon (LGAC) vessels. – Compound dimensions: 32′ × 40′, 6" thick concrete slab with 6" berm, chain-link fence all around with one man-gate and one equipment gate. – Treatment water: All extraction wells and 5 gpm of perched aquifer. – Fate of treated water: Groundwater injection wells (as discussed above) and release to on-site sanitary sewer location under a LACSD permit. – Water treatment rate: 70 gpm (including 2 downgradient wells, 1 source area extraction well, and 5 gpm for perched aquifer).

bgs = below ground surface
COC = constituent of concern
ft = feet
gpm = gallons per minute
HRC = hydrogen release compound
ISCO = in-situ chemical oxidation
LACSD = Los Angeles County Sanitation District
lbs = pounds
LGAC = liquid granular activated carbon
OD = outer diameter
OU = operable unit
ppb = parts per billion
psig = pounds per square inch gauge
PVC = polyvinyl chloride
scfm = standard cubic feet per minute
μg/L = micrograms per liter

FIGURES



URS
2870 GATEWAY OAKS DRIVE, SUITE 300
SACRAMENTO, CA 95833

Cooper Drum Superfund Site South Gate, CA	Figure 1-1 Site Location Map

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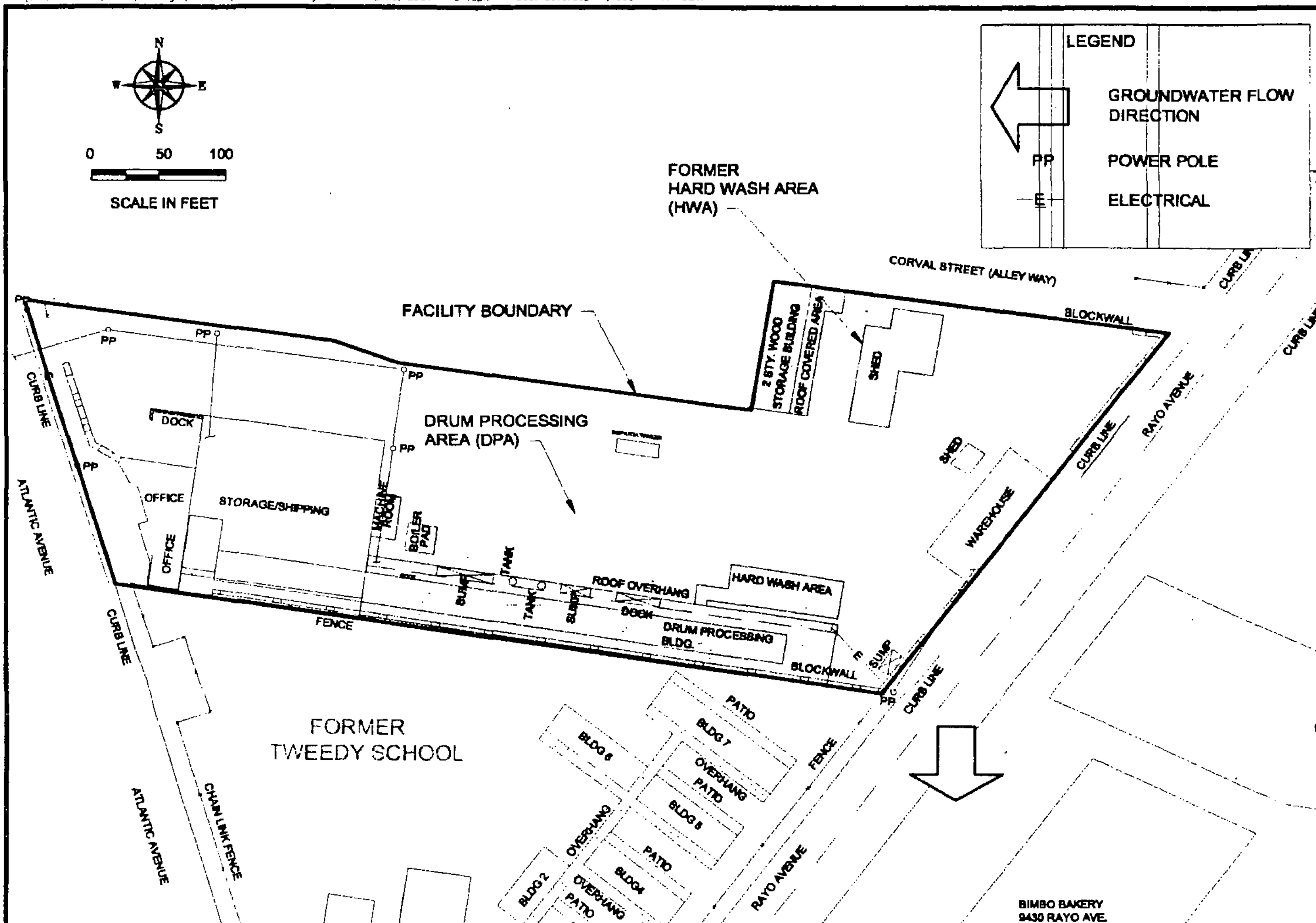
\Cooper Drum\CADD\Drawings\Exhibits\FIGURE 1-2.dwg Plotted: Sep 13, 2007 - 2:50pm Last Save: Sep 11, 2007 - 11:49am



2870 GATEWAY OAKS DRIVE, SUITE 300
SACRAMENTO, CA 95833

Cooper Drum Superfund Site
South Gate, CA

Figure 1-2
Site Layout Map

Cost Estimate Summary For The Selected Remedy For Groundwater	
Description	**Cost**
Capital Costs	
Construction	
ISCO install	$262,763
Above Ground Treatment Process install	$46,140
Treatment Compound Slab	$22,368
Treatment Compound Fence and Bollards	$23,250
Bio Barrier Install	$692,368
POTW Connection Fee	$247,125
Monitor well Install	$162,800
Treatment Trenching and Piping (Source Area)	$127,774
Treatment Trenching and Piping (Downgradient)	$143,750
Extraction and Injection Wellheads and Equipment Install (Source Area)	$128,200
Extraction Wellheads and Equipment Install (Downgradient)	$86,973
SCADA System	$25,000
Initial Startup Test	$13,500
Subtotal (construction)	$1,982,011
Bid contingencies(5% of total)	$99,101
Report preparation (RAWP, HASP, Plans, Final O&M)(5% of total)	$99,101
Field and laboratory testing during construction (1% of total)	$19,820
Reporting during construction (1% of total)	$19,820
Total Capital Cost	**$2,219,852**
OPERATIONS AND MAINTENANCE COSTS	
Subtotal O&M (discounted first three years)[a]	$929,557
Subtotal O&M (Remaining 17 years discounted) Downgradient	$1,650,387
Subtotal O&M (Discounted)	**$2,579,944**
MONITORING AND REPORTING	
Subtotal Monitoring and Reporting (Total Time- 23 yr)[a,b]	**$1,230,383**
TOTAL COST	**$6,030,179**

Date: September 13, 2007

Note: Inflation rates for 2007 through 2030 (As provided in the ROD) was factored into the 7% discount

[a] A 7% discount assumed for 20 years of O&M operation

[b] Closure sampling is assumed to occur in 2031

Detail Cost Sheet

Source Area O&M Costs				
O&M Labor Annual				$21,600
Liquid Carbon Change Out Annual				$2,000
Hydrogen Peroxide Annual				$2,761
Electricity Annual 64 kw per design drawing E-4				$72,883
O&M Labor Downgradient Extraction wWells Annual				$7,200
System service life costs Annual				$5,384
POTW permit cost Annual				$21,181
ISCO Rental Annual				$192,000
Advanced oxidation process Rental Annual				$54,000
Subtotal O&M Annual (base value)				$379,009
Year	Inflation	P/F	Discounted Inflation	Cost/Year
1	1.040	0.8734	0.8734	$331,026
2	1.066	0.8163	0.8163	$309,385
3	1.093	0.7629	0.7629	$289,146
TOTAL Present Value O&M 3 years				**$929,557**

Down Gradient Containment and Treatment O&M Costs				
O&M Labor Source Area Annual				$21,600
Liquid Carbon Change Out Annual				$2,000
Hydrogen Peroxide Annual				$2,761
Electricity Annual based on 20 kw per design drawing E-4				$22,776
O&M Labor Downgradient Annual				$7,200
System service life costs Annual				$5,384
POTW permit cost Annual				$21,181
Advanced oxidation process Rental Annual				$54,000
Subtotal O&M Annual (Base value)				**$136,902**
Year	Inflation	P/F	Discounted Inflation	Cost/Year
4	1.12	0.8734	0.98	$133,915
5	1.15	0.8163	0.94	$128,289
6	1.18	0.7629	0.90	$122,894
7	1.21	0.7130	0.86	$117,727
8	1.24	0.6663	0.82	$112,766
9	1.27	0.6227	0.79	$108,022
10	1.30	0.5820	0.76	$103,486
11	1.33	0.5439	0.72	$99,129
12	1.36	0.5083	0.69	$94,957
13	1.40	0.4751	0.66	$90,973
14	1.43	0.4440	0.64	$87,144
15	1.47	0.4150	0.61	$83,488
16	1.51	0.3878	0.58	$79,967
17	1.54	0.3624	0.56	$76,597
18	1.58	0.3387	0.54	$73,378
19	1.62	0.3166	0.51	$70,305
20	1.66	0.2959	0.49	$67,351
TOTAL Present Value 17years following the initial 3 years				**$1,650,387**

OU 1 Source Area Strategy - Capital Costs				
ISCO Costs				
Item	**Unit Cost**	**Unit**	**Quantity**	**Extended Cost**
ISCO injection points	$750	ea	24	$18,000
ISCO wellhead kits	$750	ea	24	$18,000
Sparge well install	$12,500	well	12	$150,000
Conveyance piping (including ozone and hydrogen peroxide)	$6	ft	750	$4,500
Conveyance tubing	$2.25	ft	650	$1,463
Electrical Installation	$51,800	LS	1	$51,800
Permit costs	$3,000	LS	1	$3,000
ISCO ODC's (including demob)	$10,000	LS	1	$10,000
Startup O&M Labor	$6,000	LS	1	$6,000
Subtotal				$262,763
ISCO system install and startup assist	$1,500	day	9	$13,500
Trenching costs (including labor, material costs)	$127,774	LS	1	$127,774
TOTAL				$404,037
Treatment Equipment Costs				
Item	**Unit Cost**	**Unit**	**Quantity**	**Extended Cost**
Install and startup assist	$1,500	day	5	$7,500
Demobilization costs	$1,500	unit	1	$1,500
Liquid GAC costs	$35,640	LS	1	$35,640
Freight costs (in and out)	$4,500	RT	2	$9,000
Subtotal				$46,140
Treatment pad installation and setup	$45,618	ea	1	$45,618
TOTAL				$145,398
Extraction Well Install				
Item	**Unit Cost**	**Unit**	**Quantity**	**Extended Cost**
Extraction well (20 gpm)	$30,000	ea	1	$30,000
Conveyance piping to well	$2.25	foot	200	$450
Submersible pump cost	$1,100	ea	1	$1,100
Flow meters	$3,100	ea	1	$3,100
Valves and fittings	$100	ea	10	$1,000
Traffic-Rated Well vaults	$5,000	ea	1	$5,000
Subtotal				$40,650
Injection Well Install				
Item	**Unit Cost**	**Unit**	**Quantity**	**Extended Cost**
Injection well (25 gpm)	$30,000	ea	2	$60,000
Conveyance piping to well	$2.25	foot	600	$1,350
Injection pump to well	$900	ea	2	$1,800
Flow meters	$3,100	ea	4	$12,400
Valves and fittings	$100	ea	20	$2,000
Traffic-Rated Well vaults	$5,000	ea	2	$10,000
Subtotal				$87,550
Total Extraction and Injection Wells				$128,200
Accessories				
Item	**Unit Cost**	**Unit**	**Quantity**	**Extended Cost**
SCADA system	$25,000	ea	1	$25,000

OU 1 Source Area Strategy - Recurring (O&M) Costs				
Item	Unit Cost	Unit	Quantity	Extended Cost
Preventative maintenance	$5,384	year	1	$5,384
O&M labor	$1,800	month	12	$21,600
Electricity based on 64 Kw for 24/7 operation 365yr	$0.13	kWh	560,640	$72,883
Electrical based on design drawings E-4				
Hydrogen peroxide	$2,761	year	1	$2,761
Liquid GAC changeouts	$2,000	year	1	$2,000
Ex-situ oxidation treatment unit rental	$4,500	month	12	$54,000
ISCO treatment unit rental	$16,000	month	12	$192,000

OU 1 Downgradient Area Strategy - Capital Costs

Extraction Well Installation

Item	Unit Cost	Unit	Quantity	Extended Cost
Extraction well (2*25 gpm per well)	$30,000	ea	2	$60,000
Conveyance piping to well	$2.53	foot	1150	$2,913
Submersible pump, well equip cost	$4,430	ea	2	$8,860
Well electrical permit cost	$3,000	ea	1	$3,000
Flow meters	$3,100	ea	2	$6,200
Valves and fittings	$100	ea	10	$1,000
Traffic-Rated Well vaults	$5,000	ea	1	$5,000
[redacted]				$86,973
[redacted]	$125	foot	1150	$143,750
Bioremediation Barrier Installation				
Item	**Unit Cost**	**Unit**	**Quantity**	**Extended Cost**
Carbon substrate cost- first injection	$331,245	LS	1	$331,245
Carbon substrate cost- second injection	$165,623	LS	1	$165,623
Direct push injection/ startup-1	$3,700	day	25	$92,500
Direct push injection/ startup-2	$3,700	day	15	$55,500
Technician support	$20,000	event	2	$40,000
Freight costs (in and out)	$1,500	RT	3	$4,500
Electrical permit costs (estimate from Henry O)	$3,000	LS	1	$3,000
[redacted]				$692,368
[redacted]	$247,125	LS	1	$247,125
[redacted]	$0.13	kWh	175,200	$22,776

OU 1 Downgradient Area Strategy - Recurring (O&M) Costs

Item	Unit Cost	Unit	Quantity	Extended Cost
O&M cost (2 technicians- 12 hrs/event - quarterly sampling - 1 year)	$75	hr	96	$7,200
[redacted]	$21,181	year	1	$21,181

Annual Performance Monitoring					$50,285
Year	Inflation	P/F	Discounted Inflation	Cost/Year	
1	1.040	0.8734	0.91	$45,676	
2	1.066	0.8163	0.87	$43,757	
3	1.093	0.7629	0.83	$41,917	
4	1.120	0.7130	0.80	$40,155	
5	1.148	0.6663	0.76	$38,463	
6	1.177	0.6227	0.73	$36,844	
7	1.206	0.5820	0.70	$35,297	
8	1.236	0.5439	0.67	$33,811	
9	1.267	0.5083	0.64	$32,388	
10	1.299	0.4751	0.62	$31,029	
11	1.331	0.4440	0.59	$29,723	
12	1.365	0.4150	0.57	$28,476	
13	1.399	0.3878	0.54	$27,275	
14	1.434	0.3624	0.52	$26,126	
15	1.469	0.3387	0.50	$25,028	
16	1.506	0.3166	0.48	$23,980	
17	1.544	0.2959	0.46	$22,972	
18	1.582	0.2765	0.44	$22,003	
19	1.622	0.2584	0.42	$21,076	
20	1.663	0.2415	0.40	$20,190	
21	1.704	0.2257	0.38	$19,341	
22	1.747	0.2109	0.37	$18,525	
23	1.790	0.1971	0.35	$17,745	
		23 YEAR TOTAL		$681,798	

SOURCE AREA EXTRACTION AND INJECTION WELLS 3 YEARS					$7,740
Year	Inflation	P/F	Discounted Inflation	Cost/Year	
1	1.040	0.8734	0.91	$7,031	
2	1.066	0.8163	0.87	$6,735	
3	1.093	0.7629	0.83	$6,452	
		3 YEAR TOTAL		$20,218	

Annual ISCO WDR Monitoring					$62,957
Year	Inflation	P/F	Discounted Inflation	Cost/Year	
1	1.040	0.8734	0.91	$57,186	
2	1.066	0.8163	0.87	$54,783	
3	1.093	0.7629	0.83	$52,480	
		3 YEAR TOTAL		$164,449	

Annual HRC WDR Monitoring					$34,100
Year	Inflation	P/F	Discounted Inflation	Cost/Year	
1	1.040	0.8734	0.91	$30,974	
2	1.066	0.8163	0.87	$29,673	
3	1.093	0.7629	0.83	$28,425	
4	1.120	0.7130	0.80	$27,230	
5	1.148	0.6663	0.76	$26,083	
		5 YEAR TOTAL		$142,385	

Annual Treatment System Monitoring					$14,720
Year	Inflation	P/F	Discounted Inflation	Cost/Year	
1	1.040	0.8734	0.91	$13,371	
2	1.066	0.8163	0.87	$12,809	
3	1.093	0.7629	0.83	$12,270	
4	1.120	0.7130	0.80	$11,754	
5	1.148	0.6663	0.76	$11,259	
6	1.177	0.6227	0.73	$10,785	
7	1.206	0.5820	0.70	$10,333	
8	1.236	0.5439	0.67	$9,898	
9	1.267	0.5083	0.64	$9,481	
10	1.299	0.4751	0.62	$9,083	
11	1.331	0.4440	0.59	$8,701	
12	1.365	0.4150	0.57	$8,336	
13	1.399	0.3878	0.54	$7,984	
14	1.434	0.3624	0.52	$7,648	
15	1.469	0.3387	0.50	$7,326	
16	1.506	0.3166	0.48	$7,020	
17	1.544	0.2959	0.46	$6,725	
18	1.582	0.2765	0.44	$6,441	
19	1.622	0.2584	0.42	$6,170	
20	1.663	0.2415	0.40	$5,910	
		20 YEAR TOTAL		$183,304	

Annual POTW Monitoring					$3,070
Year	Inflation	P/F	Discounted Inflation	Cost/Year	
1	1.040	0.8734	0.91	$2,789	
2	1.066	0.8163	0.87	$2,671	
3	1.093	0.7629	0.83	$2,559	
4	1.120	0.7130	0.80	$2,452	
5	1.148	0.6663	0.76	$2,348	
6	1.177	0.6227	0.73	$2,249	
7	1.206	0.5820	0.70	$2,155	
8	1.236	0.5439	0.67	$2,064	
9	1.267	0.5083	0.64	$1,977	
10	1.299	0.4751	0.62	$1,894	
11	1.331	0.4440	0.59	$1,815	
12	1.365	0.4150	0.57	$1,739	
13	1.399	0.3878	0.54	$1,665	
14	1.434	0.3624	0.52	$1,595	
15	1.469	0.3387	0.50	$1,528	
16	1.506	0.3166	0.48	$1,464	
17	1.544	0.2959	0.46	$1,402	
18	1.582	0.2765	0.44	$1,343	
19	1.622	0.2584	0.42	$1,287	
20	1.663	0.2415	0.40	$1,233	
		20 YEAR TOTAL		$38,230	

Total Present Value Costs for Monitoring Life of Project	$1,230,383

COOPER DRUM MONITORING COST (GW BDR)

PERFORMANCE MONITORING **$1,156,560**

Annual Cost	$50,285.22

Monitoring required for 23 years

24 Wells-quarterly sampling for 10 years (3 rounds x 10 yrs=30 events)
32 wells- annually for 23 years (= 23 events)
After 10 years sampling frequency reduced to semi-annual(= 13 events)
VOCs quarterly @ $100/sample
1,4-dioxane twice per yr @ $175 sample
MNA parameters annually @ $515 per sample
Labor and equipment @$290per well
(Includes Blaintech, technician, shipment, waste disposal)
(MNA includes chloride,nitrate, sulfate, sulfide, ethene/ethane/menthane,
plus field parameters, iron (II), pH, DO, ORP, Temp, conductivity)

Reporting will be don under performance monitoring after 10th year for remaining 13 years ($2.5K per rpt)

VOCs only (2 events /yr x 10years x 24 wells x [$100 + $290])= $187,200
VOCs and 1-4Dioxane (1 event/yr x 23 yr x 24 wells x [275 +290])= $311,880
MNA (1 event/yr x 23 yrs x 32 wells x [$515- $290])= $592,480
Reports (13 yrs x 2 rpt/yr x $2.5K/rpt)= $65,000

SOURCE AREA EXTRACTION AND INJECTION WELLS 3 YEARS **$23,220**

Annual Cost	$7,740.00

1 source area extraction well quarterly for 3 years (same analysis as ISCO MW's)

4/yr x 3 yr x $645= $7,740
2 source area injection wells quarterly for 3 years (same analyis as ISCO monitor well)
4/yr x 3 yrs x 2 wells x $645= $15,480

ISCO WDR **$188,870**

Annual Cost	$62,956.67

Duration of WDR permit will be for 3 years at which time sampling will shift to

Performance Monitoring Program
10 wells quarterly sampling for 3 years
(6 monthly, one baseline, 10 additional sampling events = 17 total events)

Assumes 6 of 10 wells will be sampled as part of performance Monitoring program)

Quarterly reporting ($1.5K per report, $4K for final rpt)
Analysis $645 per sample(includes VOCs, 1,-4 dioxane, chloride, bromide, nitrate, nitrite, o-phosphate, sulfate, sulfide, TOC, TOC, TDS, TSS, boron,barium, calicium, magnesium, manganese, potassium, sodium,PP metals annually,and field parameters)
17 events x 4 wells x ($645+$290)=$63,580
5 events x 6 wells x ($645+290)= $28,050
12 events x 6 wells x ($645 -$100vocs= $545)=$39,240
36 reports plus one final = $58,000

HRC WDR **$170,500**

Annual Cost	$34,100.00

Duration of WDR permit will be for 10 years at which time sampling and

reporting will shift to Performance Monitoring Program
10 wells - quarterly sampling for 5 years (= 20 sampling events)
Assumes 6 of 10 wells will be sampled under performance monitoring program
Quarterly reporting ($1.5K per report, $4K for final rpt)
Analytical $715 per well (includes VOCs, 1,-4 dioxane, ethene/ethane, carbon dioxide, methane, chloride, nitrate, nitrite, o-phosphate, sulfate, sulfide, alkalinity, TOC, TDS, BOD, boron, calcium, magnesium, iron, potassium, sodium,and field parameters)
20 events x 4 wells x ($715+$290)= $80,400
5 events x 6 wells x ($715 - $515 = $200)=$6,000
5 events x 6 wells x ($715 - $275 = $440)=$13,200
10 events x 6 wells x ($715 - $100 = $615)= $36,900
20 reports plus one final, (41 rpts x $1.5K)= $34,000

TREATMENT SYSTEM 20 YEAR $294,400

Annual Cost	$14,720.00

4/yr x 20yrs x 2 wells x $715= $114,400
Treatment plant monitoring influent and effluent locations monthly for 20 years (VOCs and 1,4-dioxane only)
12/yr x 20 yrs x 2 x $275= $132,000
Intermediate treatment plant – 2 locations- monthly - 20 years- VOCs only
12/yr x 20 yrs x 2 x $100=$48,000
All sampling performed during O&M.
Source area injection and extraction wells
Sample Reporting included in specific WDR

POTW $61,400

Annual Cost	$3,070.00

System operation 20 years
1 sampling location COD and TSS, and VOC analysis only
COD ($20) and TSS ($25) bi-monthly
6/yr x 20 yrs x $45=$5,400
VOC ($100) quarterly
4/yr x 20 yrs x $100= $8000
Quarterly reports ($600each)
4/yr x 20 yrs x $600=$48,000

TOTAL MONITORING COST $1,894,950

NEW WELL INSTALLATION $162,800

13 new wells at $100/foot (1300 ft)=$130K
Includes material and development (4-inch pvc/12-inch boring)
Labor 195 hr x $90/hr + 15% = $20.18K
expenses $3.3K
Waste disposal 1300ft x 0.82 ft3/12-inch= 67 tons
$100/ton x 67 tons = $6.7K$
Permits $200 each x 13= $2,600

Source Area Treatment System Equipment Service Life and Replacement Costs

Equipment	Expected Service Life[1] (years)	Estimated Replacement Purchase Price[2]	Estimated Replacement Labor Cost[3]	Total Estimated Replacement Cost	Expected replacement interval	Extended cost
Subsystem: Influent Tanks						
EP-1 Injection Pump	7	$560	$210	$770	1	$770
T-100 Holding Tank	20	$5,500	$2,120	$7,620	0	$0
Subsystem: Advanced Oxidation System						$0
Advanced Oxidation System	7	$730	$210	$940	1	$940
Subsystem: Carbon Vessels					0	$0
Primary Liquid Phase Carbon Vessel	20	$4,257	N/A[4]	$4,257	0	$0
Secondary Liquid Phase Carbon Vessel	20	$4,257	N/A[4]	$4,257	0	$0
GWTP Effluent Flow Meter	7	$5,000	$2,120	$7,120	1	$7,120
Subsystem: GWTP Controls						
Main Control Panel Central Processing Unit	5	$2,000	$3,560	$5,560	3	$16,680
Advanced Oxidation System Control Panel Radio	7	$2,000	$420	$2,420	1	$2,420
SCADA Computer	5	$1,200	$2,000	$3,200	3	$9,600
GWTP Programmable Logic Controller	20	$11,000	N/A4	$11,000	0	$0
Subsystem: Submersible Pump/Motor Assemblies						
SEW-1 pump and motor assembly	10	$1,033	$3,340	$4,373	1	$4,373
Subsystem: Extraction Well Flow Meters						
SEW-1 flow meter	10	$2,400	$420	$2,820	1	$2,820
Subsystem: Extraction Well Hardware						
Check Valve	10	$75	$140	$215	1	$215
Gate Valve	10	$100	$175	$275	1	$275
Well Vault Sump Pump	10	$110	$35	$145	1	$145
Miscellaneous Hardware (e.g., pressure gauges, ball valves, and GFCI outlets)	10	$100	$70	$170	1	$170
Subsystem: Extraction Well Controls						$0
TimeMark Controller	10	$150	$175	$325	1	$325
Submersible Motor Starter	10	$125	$210	$335	1	$335
Control Panel Breaker	10	$150	$210	$360	1	$360
					Total	$46,548

Notes:

1. Expected service life is based on O&M contractor's experience and information obtained from equipment manufacturers.
2. Estimated replacement purchase prices were obtained from manufacturers or vendors, and are in 2007 dollars.
3. Estimated replacement installation cost includes labor costs, subcontractor costs, and equipment rental costs. The following costs
4. Labor costs are not estimated for this activity due to extensive project coordination requiredor a lifecycle greater than 100 years.
5. Estimated replacement installation cost includes labor costs and subcontractor costs. The following costs were used in generating

SEW = source area extraction well

Downgradient Treatment System Equipment Service Life and Replacement Costs

Equipment	Expected Service Life[1] (years)	Estimated Replacement Purchase Price[2]	Estimated Replacement Labor Cost[3]	Total Estimated Replacement Cost	Expected replacement interval	Extended cost
Subsystem: Bioremediation Barrier						
Biobarries	7		$210	$210	0	$0
Effluent Flow Meter	7	$5,000	$2,120	$7,120	6	$42,720
Subsystem: Submersible Pump/Motor Assemblies						
DEW-1 pump and motor assembly	10	$1,220	$3,340	$4,560	1	$4,560
DEW-2 pump and motor assembly	10	$1,220	$3,340	$4,560	1	$4,560
Subsystem: Extraction Well Flow Meters						
DEW-1 flow meter	10	$2,400	$420	$2,820	1	$2,820
DEW-2 flow meter	10	$2,400	$420	$2,820	1	$2,820
Subsystem: Extraction Well Hardware						
Check Valves	10	$75	$140	$215	2	$430
Gate Valves	10	$100	$175	$275	2	$550
Well Vault Sump Pumps	10	$110	$35	$145	2	$290
Miscellaneous Hardware (e.g., pressure gauges, ball valves, and GFCI outlets)	10	$100	$70	$170	2	$340
Subsystem: Extraction Well Controls						
TimeMark Controller	10	$150	$175	$325	2	$650
Submersible Motor Starter	10	$125	$210	$335	2	$670
Control Panel Breaker	10	$150	$210	$360	2	$720
					Total	$61,130

Total replacement cost
Annual $5,384

Notes:

1. Expected service life is based on O&M contractor's experience and information obtained from equipment manufacturers.
2. Estimated replacement purchase prices were obtained from manufacturers or vendors, and are in 2007 dollars.
3. Estimated replacement installation cost includes labor costs, subcontractor costs, and equipment rental costs. The following costs
4. Labor costs are not estimated for this activity due to extensive project coordination requiredor a lifecycle greater than 100 years.
5. Estimated replacement installation cost includes labor costs and subcontractor costs. The following costs were used in generating

SEW = source area extraction well

Item	Cost	
Check valve	$	75
Gate Valve	$	100
Sump Pumps	$	110
Miscellaneous	$	100
Drop Pipe - 1.5" Stainless	$	7
Drop Pipe - 2" Stainless	$	9
Drop Pipe - 3" Stainless	$	30
Drop Pipe threading	$	10
TimeMark	$	150
Submersible Motor Starter	$	125
Control Panel Breakers	$	150
LABOR	$	70
Subcontractor	$	100
Redevelopment - Sub	$	2,500
Crane	$	1,000
Manlift	$	700
Forklift	$	500

Notes

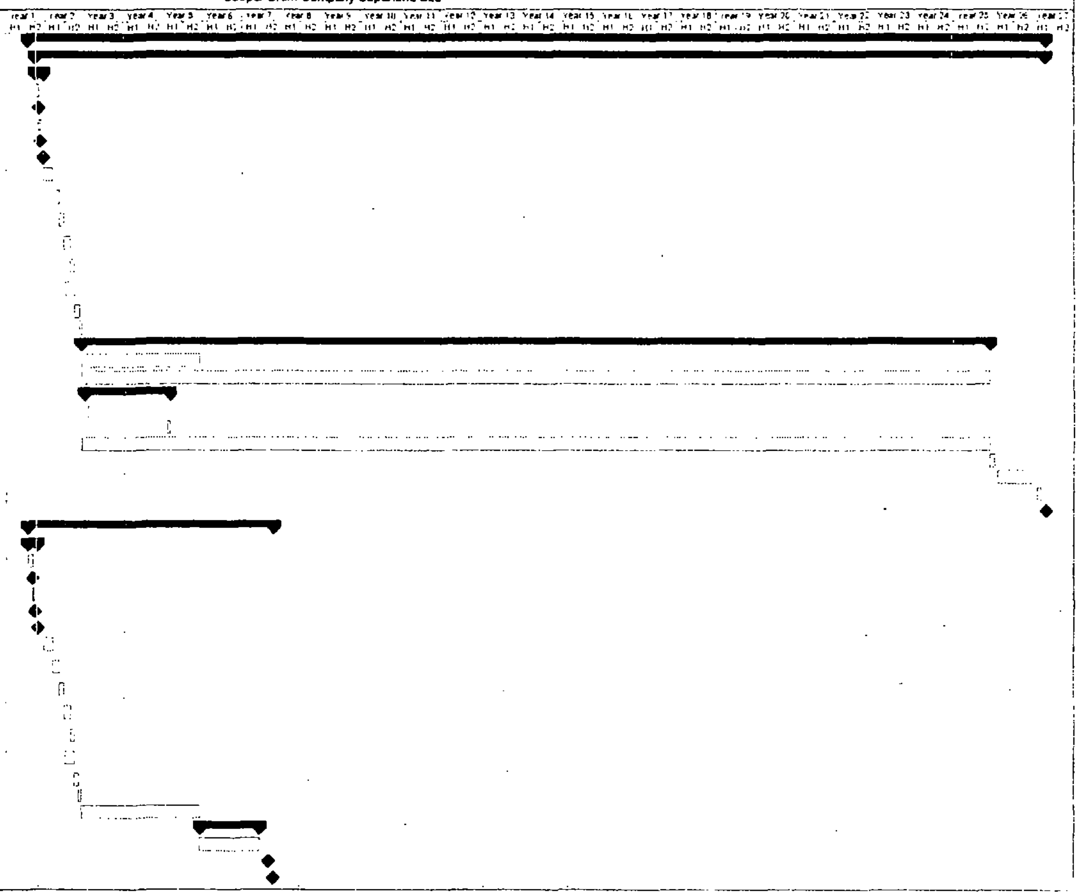
EW Assumptions

assume labor = 12 hours per submersible replacement, with $2,500 for sub costs

assume flow meter replacement labor = 6 hours

OU 1 and OU 2
Remedial Action Schedule
Cooper Drum Company Superfund Site

ID	Task Name	Duration	Predecessors
1	**Cooper Drum Remedial Actions**	**6723 days**	
2	**OU 1 (Groundwater) RA**	**6874 days**	
3	**RA Solicitation**	**64 days**	
4	Post solicitation	30 edays	
5	Receive proposals	0 days	4
6	Review solicitation proposals	10 days	5
7	Award solicitation	0 days	6
8	Notice-to-Proceed	0 days	7FS+30 edays
9	Preparation of Draft Plans (RAWP, SAP, HASP)	60 days	8
10	Regulatory Agencies Review of Draft Plans	60 edays	9
11	Incorporate Comments and Submit Draft Final Plans	30 days	10
12	Regulatory Agencies Review of Draft Final Plans	60 edays	11
13	Incorporate Comments and Submit Final Plans	30 days	12
14	Permitting for RA (WDR, NPDES, Building Dept, etc)	90 edays	13FF
15	Installation of Remedy	30 days	14
16	Initial Startup and Testing	15 days	15
17	**Full Scale O&M of RA Remedy**	**[illegible] days**	
18	Source Area in situ ISCO system	1095 edays	16
19	Downgradient P&T System	6395 edays	16
20	**Biobarrier Injections**	**961 days**	
21	First Injection	30 edays	19SS+30 edays
22	Second Injection	25 edays	21FS+730 edays
23	Remedy Performance Monitoring	6395 edays	16
24	Site Closure Work Plan	30 days	23
25	Site Closure Sampling/Monitoring	365 edays	24FS+30 edays
26	Site Closure Monitoring Results Report	30 days	25
27	Receive Site Closure	0 days	26FS+45 edays
28	**OU 2 (Soil) RA**	**1828 days**	
29	**RA Solicitation**	**62 days**	
30	Post solicitation	30 days	
31	Receive proposals	0 days	30
32	Review solicitation proposals	10 days	31
33	Award solicitation	0 days	32
34	Notice-to-Proceed	0 days	33FS+30 edays
35	Preparation of Draft Plans (RAWP, SAP, HASP)	60 days	34
36	Regulatory Agencies Review of Draft Plans	60 edays	35
37	Incorporate Comments and Submit Draft Final Plans	30 days	36
38	Regulatory Agencies Review of Draft Final Plans	60 edays	37
39	Incorporate Comments and Submit Final Plans	30 days	38
40	Permitting for RA (WDR, NPDES, Building Dept, etc)	90 edays	39FF
41	Installation of Remedy	30 days	40
42	Initial Startup and Testing	15 days	41
43	Full Scale O&M of RA Remedy	1095 edays	42
44	**Remedy STOP Evaluation**	**306 days**	
45	Site Closure Sampling/Monitoring	550 edays	43
46	Submit Remedy STOP Report	0 days	44FS+60 days
47	Receive Approval to STOP OU 2 RA	0 days	46FS+45 edays



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SOIL REMEDIAL DESIGN REPORT

OPERABLE UNIT 2

COOPER DRUM COMPANY SUPERFUND SITE

Prepared for:

Contract No. 68-W-98-225/WA No. 047-RDRD-091N
U.S. Environmental Protection Agency, Region IX
75 Hawthorne Street
San Francisco, California 94105

Prepared by:

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September 18, 2007

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ACRONYMS AND ABBREVIATIONS

AOC	Administrative Order of Consent
ARAR	applicable or relevant and appropriate requirements
ASTM	American Society for Testing and Materials
BDR	basis of design
bgs	below ground surface
CatOx	catalytic oxidation
CCR	California Code of Regulations
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
cfm	cubic feet per minute
CFR	Code of Federal Regulations
COC	contaminant of concern
CQCP	Construction Quality Control Plan
cy	cubic yard
DCA	dichloroethane
DCE	dichloroethene
DCP	dichloropropane
DL	detection limit
DPA	drum processing area
DPE	dual-phase extraction
DTSC	California Department of Toxic Substances Control
EPA	United States Environmental Protection Agency
FSP	field sampling plan
GAC	granular activated carbon
gpm	gallons per minute
HASP	Health and Safety Plan
hp	horsepower
HRA	health risk assessment
HRC	hydrogen release compound
HWA	hard-wash area
I&C	instrumentation and control
in. H_2O	inches of water
in. Hg	inches of mercury
ISCO	in situ chemical oxidation
LADHS	Los Angeles County Department of Health Services
LACSD	Los Angeles County Sanitation District

ACRONYMS AND ABBREVIATIONS (Continued)

lb/day	pounds per day
LEL	lower explosive limit
LGAC	liquid-phase granular activated carbon
MCL	California maximum contaminant level
mg/kg	milligrams per kilogram
NCP	National Oil and Hazardous Substances Pollution Contingency Plan
NEC	National Electrical Code
NFPA	National Fire Protection Association
NPL	National Priorities List
O&M	operation and maintenance
OU	operable unit
PAH	polycyclic aromatic hydrocarbon
PCE	tetrachloroethene
PCB	polychlorinated biphenyl
PFD	process flow diagram
PLC	programmable logic controller
POC	point of contact
ppb	parts per billion
ppbv	parts per billion by volume
ppmv	parts per million by volume
PRP	potentially responsible party
PVC	polyvinyl chloride
QA	quality assurance
RA	remedial action
RAO	remedial action objective
RAWP	Remedial Action Work Plan
RD	remedial design
RDR	remedial design report
RI/FS	remedial investigation/feasibility study
ROD	record of decision
ROI	radius of influence
RPO	remedial process optimization
RWQCB	Regional Water Quality Control Board
SAP	Sampling and Analysis Plan
SARA	Superfund Amendments and Reauthorization Act of 1986
SCAQMD	Southern California Air Quality Management District
scfm	standard cubic feet per minute
SVE	soil vapor extraction

ACRONYMS AND ABBREVIATIONS (Continued)

SVOC	semivolatile organic compound
TBC	to be considered
TBD	to be determined
TCE	trichloroethene
TCP	trichloropropane
TDS	total dissolved solids
TEFC	totally enclosed, fan-cooled
URS	URS Group, Inc.
VC	vinyl chloride
VGAC	vapor granular activated carbon
VOC	volatile organic compound
VP	vapor monitor points
WDR	Waste Discharge Requirement
XRF	X-ray fluorescence
°C	degrees Celsius
µg/L	micrograms per liter

ES.0 EXECUTIVE SUMMARY

In June 2001, the United States Environmental Protection Agency (EPA) added the Cooper Drum Company Site (Site) to the National Priorities List (NPL) of hazardous waste sites requiring remedial action (RA). This Remedial Design Report (RDR) presents the remedial design for the selected RA for the soil Operable Unit 2 (OU 2) at the Site, located in South Gate, Los Angeles County, California. The remedial design (RD) for Operable Unit 1 (OU 1), or the contaminated site groundwater, is presented in a separate RDR.

The OU 2 (alternatively referred to as "impacted soil" or simply "soil" throughout this report) RA includes dual-phase extraction (DPE) for subsurface soils down to the water table, excavation of near surface soils, and institutional controls where excavation is not feasible.

This RDR provides the design criteria, including the assumptions and parameters used in developing the RD for OU 2 soil, and the estimated costs and schedule for implementation of the RA. The soil RD closely follows the selected remedy for soil, as delineated in the Site Record of Decision (ROD) (EPA, 2002).

ES.1 CONTAMINANTS OF CONCERN AND CLEANUP GOALS

The ROD identifies the contaminants of concern (COCs) as volatile organic compounds (VOCs) in soil gas and non-VOCs, including lead, polycyclic aromatic hydrocarbons (PAHs), and polychlorinated biphenyls (PCBs), in soil.

The ROD specifies the cleanup goals for VOCs as "to be determined (TBD)," pending collection of soil gas samples after implementation of the RA. The soil gas concentrations are to be used in the VLEACH (or comparable) model to predict impact to groundwater, and in the Johnson and Ettinger model to estimate indoor air concentrations. Remediation of soil gas is to continue until predicted impacts to groundwater are at levels less than drinking water standards, and predicted indoor air concentrations are less than levels that would pose a human health risk.

The ROD specifies the cleanup goal for PCBs in soil as 870 parts per billion (ppb). This level was back-calculated by applying residential exposure parameters used in the Site human health risk assessment and a target health risk level of 1 in 100,000. The ROD also describes the cleanup level for PAHs in soil as being based on the upper tolerance limit background benzo(a)pyrene-toxicity equivalent (B(a)P-TE) concentration for the southern California PAH data set, which is 900 ppb B(a)P-TE. Finally, the ROD specifies a cleanup goal for lead of 400 parts per million (ppm). This level was established based on an evaluation of lead uptake of children's blood.

Post-ROD supplemental investigations of the Site indicated the presence of elevated levels of 1,4-dioxane (a semivolatile organic compound [SVOC]) in the perched aquifer and shallow groundwater. A cleanup goal for 1,4-dioxane was not specified in the ROD. However, other regulatory criteria can be used as a basis for cleanup. The drinking water preliminary remediation goal (PRG) for 1,4-dioxane is 6.1 micrograms per liter (µg/L), and the Department of Health Services (DHS) action level for this compound is 3 µg/L. The cleanup goal for 1,4-dioxane will be assessed during implementation of the RA.

ES.2 ROD SELECTED REMEDY FOR OU 2 SOIL

The remedial action objectives (RAOs) for Cooper Drum, as stated in the ROD, are to protect human health and the environment from exposure to contaminated soil, groundwater, and indoor air, and to restore the groundwater to a potential beneficial use as a drinking water source. The ROD-selected remedy meets these RAOs through treatment of soil and groundwater contaminated with COCs.

The ROD specifies the following remedial design strategy for remediation of contaminated soil at the Site:

- To remove the potential threat to human health, the selected remedy for soil will use DPE for treatment of VOCs in soil.
- Other non-VOC soil contaminants, including PAHs, PCBs, and lead, will be excavated for disposal.
- Institutional controls will be implemented to prevent exposure to soil contaminants where excavation is not feasible.

ES.3 DESIGN STRATEGY FOR IMPACTED SOIL

Two depth intervals will require remedial action: surface to near-surface soils impacted with non-VOCs, and a deeper vadose zone impacted with VOCs and 1,4-dioxane (perched aquifer only).

The soil RD is divided by affected media: soil vapor (gas) and perched groundwater and soil. The vadose zone and the perched aquifer are impacted in two areas of the Site: the former hard wash area (HWA) and the drum processing area (DPA).

ES.3.1 Soil Vapor and Perched Aquifer

The RD uses DPE to simultaneously extract soil vapors and dewater the perched aquifer, which in turn expands the effect of soil vapor extraction in the dewatered zone. Extracted soil vapor will be treated at an on-site treatment system, using catalytic oxidation, followed by acid scrubbing. When influent vapor concentrations decrease to below approximately 150 parts per million by volume (ppmv) the emission controls system will be switched to granular activated carbon (GAC)

DPE will be performed prior to excavation of the shallow soils.

The DPE design also includes dewatering of the perched aquifer, which is continuous in the HWA and DPA, and occurs from approximately 35 to 40 feet below ground surface (bgs). The perched aquifer is a stratified layer within the Bellflower Aquiclude, which also includes the deeper Gaspur and Exposition aquifers. The extracted water, at an estimated design rate of 5 gallons per minute (gpm), from the perched aquifer will be conveyed to the treatment compound where it will be treated in an advanced oxidation process unit (mainly to treat 1,4-dioxane), followed by a liquid-phase granular activated carbon (LGAC) polishing unit. The treated groundwater will then be discharged via two mechanisms: injection (using two injection wells located in the vicinity of the HWA) into the impacted Gaspur aquifer, and discharge to the sanitary sewer. (The same treatment and discharge sequence will be used to treat extracted water from the impacted Gaspur aquifer as part of the groundwater RA; therefore, the water from the two aquifers will be indistinguishable during treatment and discharge processes.)

Removal of VOCs from soil will prevent the downward migration of these compounds at concentrations that would impact groundwater at levels greater than drinking water standards, or their upward migration at concentrations that would cause indoor health risks. Dewatering and treatment of the impacted water from the perched aquifer will expose more of the vadose zone for vapor extraction.

Two existing soil vapor extraction (SVE) wells and four existing vapor monitor points are incorporated in the RD. However, each existing SVE well is to be converted to a DPE well by installing a well with a submersible pump (lowered to the perched aquifer) within approximately 5 feet of the SVE well. Inside each DPE well, extracted water will be conveyed via a water outlet and extracted vapor will be transferred via a vapor outlet to the treatment compound. This same design is used in all (new) DPE wells. (See Drawing P-1, which shows the process flow for the soil remediation system.)

SVE tests at the Site indicate the SVE radius of influence (ROI) is approximately 55 feet. Based on this ROI estimate, and using the 1,000 parts per billion by volume (ppbv) composite soil gas VOC plume as a conservative boundary for the area requiring RA, seven new DPE wells (five new wells in the HWA and two new wells in the DPA) also are included in the RD. The SVE depth interval is from approximately 10 to 30 feet bgs. Correspondingly, the RD includes installation of 13 new vapor monitor wells (nine in the HWA and four in the DPA), mostly within 25 to 50 feet from the SVE wells, with monitoring depths at 10, 20, and 30 feet bgs.

ES.3.2 Soil

The RD includes the removal of Site surface and near surface soil that is impacted with non-VOCs at levels exceeding the cleanup goals, as described in Section ES.1.

Initial soil removal activities will consist of four excavation areas (two areas each in the HWA and DPA) to maximum depths ranging from 2 feet bgs to 5 feet bgs. Excavation will be conducted to 5 feet bgs because the main concern is to prevent direct exposure to near surface contaminated soil. For soils deeper than 5 feet, the ROD allows, "implementation of institutional controls for soil contaminated with non-VOCs in areas where excavation is not feasible, such as under existing structures."

Confirmation soil samples will be collected at the excavation areas (the excavation walls and floor) to ensure that all impacted soils are removed from the Site. Pending the confirmation sampling analytical results, additional excavation of Site soils may be necessary. All excavated soils will be transported and disposed of at an approved off-site facility. All excavated areas will be backfilled with clean soil material.

Removal of non-VOCs to the health-based cleanup levels will protect receptors at or near the site during ongoing and future activities. However, institutional controls will be implemented for soil contaminated with non-VOCs in areas where excavation is not feasible, such as under existing structures. Therefore, hazardous waste will remain at the property at levels not suitable for unrestricted use of the land. In this case, institutional controls will be implemented in the form of a State Land Use Covenant with the property owner. The Covenant shall conform with the requirements of pursuant to Civil Code section 1471, Health and Safety Code section 25355.5 and the California Code of Regulations, title 22, section 67391.1.

1.0 INTRODUCTION

In June 2001, the United States Environmental Protection Agency (EPA) added the Cooper Drum Company Site (Site) to the National Priorities List (NPL) of hazardous wastes sites requiring remedial action. URS Group, Inc. (URS) completed a remedial investigation/feasibility study (RI/FS) report for the Site in May 2002. The RI/FS summarized previous investigations; the nature and extent of contamination; a human health risk assessment (HRA); contaminants of concern (COCs); RI activities, conclusions, and recommendations; remedial action (RA) objectives; and an evaluation of RA alternatives. The selected RAs for soil and groundwater were documented in the Record of Decision (ROD). The site has been categorized into two operable units (OUs) for the remedial phase: OU 1 consists of the impacted groundwater and OU 2 consists of the impacted soil (and a perched aquifer) in the source area. This Remedial Design Report (RDR) describes the initial phase of remedial activity for the Site and presents the design for the soil (OU 2) RA.

1.1 PURPOSE AND OBJECTIVES

This RDR presents the design for two selected soil RAs at the Cooper Drum Company Site in South Gate, Los Angeles County, California. The two soil RAs include a limited surface to near-surface soil removal for soils impacted with heavy metals, polychlorinated biphenyls (PCBs) and polycyclic aromatic hydrocarbons (PAHs) and a deeper vadose zone RA for volatile organic compound (VOC)-impacted soil. This RDR provides the design criteria, including the design, assumptions, and parameters used in developing the remedial design (RD) for OU 2. The RAs were chosen in accordance with the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) of 1980, as amended by the Superfund Amendments and Reauthorization Act of 1986 (SARA), and, to the extent possible, the National Oil and Hazardous Substances Pollution Contingency Plan (NCP). The decision was based on the Administrative Record file for the Cooper Drum Company Site and is detailed in the *Record of Decision, Cooper Drum Company, City of Southgate, California Record of Decision* (EPA, 2002). The implementation of the two soil RAs will be as follows: the deeper vadose zone RA will be completed prior to the shallow vadose zone RA. The work will be performed in this sequence to minimize worker exposure to site contamination during the shallow vadose zone RA.

1.2 SITE DESCRIPTION AND HISTORY

1.2.1 Site Description

The Site is located at 9316 South Atlantic Avenue in South Gate, Los Angeles County, California. It is identified as EPA ID CAD055753370 (Latitude 33 56' 49" N, Longitude 118 11'42" W). The Site, which consists of 3.8 acres of mixed residential, commercial, and industrial land use, is 10 miles south of Los Angeles and approximately 1,600 feet west of the Los Angeles River (Figure 1-1). Site facilities include drum processing and storage areas, an office, a warehouse, and maintenance buildings. The former hard-wash area (HWA) is in the northeastern area of the Site, which includes a covered shed area. The drum processing building, which is referred to as the Drum Processing Area (DPA) in this report, is located along the southern property boundary. The Site layout, including the HWA and DPA, is shown on Figure 1-2. All Site buildings have concrete floors, and the entire facility has been asphalt-paved since

1986. The Tweedy School on the adjacent property has been closed since 1988 because of a concern that children attending the school could be exposed to contamination migrating off site.

1.2.2 Site History

Since 1941, the Site has been used by several companies to recondition and recycle used steel drums that once contained various industrial chemicals. The Cooper Drum Company operated from 1972 to 1992, reconditioning drums using a process that consisted of flushing and stripping the drums for painting and resale. Drum process waste was collected in open concrete sumps and trenches, resulting in releases to soil and groundwater beneath the site.

Following is a history of the Site use for the reconditioning and recycling of steel drums containing residual chemicals.

- Since 1941, the northern portion of the Site has been owned and operated by drum recycling companies. The use and ownership of the southern portion of the site prior to 1971 is unclear. The Cooper Drum Company purchased both parcels and operated the facility from 1972 until 1992.
- Reconditioning activities took place within the present-day DPA (Figure 1-2), in the central portion of the Site. When necessary, heavy duty cleaning, called "hard washing," was performed in the northeastern portion of the site (the former HWA shown on Figure 1-2). Caustic fluids, generated by reconditioning and hard washing activities, and waste materials removed from inside the drums were collected in open concrete sumps and trenches. This led to the contamination of the soil and groundwater beneath the Site. Recent investigations have shown that most Site contamination can be traced to the HWA and the DPA.
- Beginning in 1987, the Cooper Drum Company facilities were retrofitted to provide better environmental protection. Closed-top steel tanks were installed over the sumps, and the trenches were replaced with hard piping. The former HWA was closed and replaced with a new hard-wash area in the DPA, which also provided hard piping and secondary containment.

The Cooper Drum Company continued to operate the facility until 1992. In 1992, the drum reconditioning business was sold to Waymire Drum Company, which operated the facility until 1996. Since 1996, Consolidated Drum Company has been the drum-reconditioning operator at the site. The facility was refitted to process plastic totes (large square containers). Consolidated Drum used an aboveground, enclosed system for containing liquids and wastes until their departure in 2003.

1.2.3 Current Site Operations

Consolidated Drum Company terminated its lease with the Cooper Trust in October 2003 and moved its operations to off-site facilities. All drum-recycling equipment and associated containment piping and tanks were removed from the site. Currently, the site is fully operational; however there are no longer any drum operations. As of April 2004, there were three new tenants on site, including a pallet storage company, a towing company, and an automotive repair and salvage company. This last company moved out as of May 26, 2006, and the pallet company expanded into the available space.

1.3 REMEDIAL DESIGN REPORT ORGANIZATION

This RDR includes the following:

- Section 1.0 A brief introduction of the site and the purpose of the RD
- Section 2.0 A summary of the remedial investigations performed at the site
- Section 3.0 The general project approach and design objective
- Section 4.0 The design for the non-VOC soil removal action
- Section 5.0 The design for the VOC-impacted vadose zone remediation
- Section 6.0 Construction and Implementation of the Remedial Design
- Section 7.0 The environmental and public impact reduction plan

2.0 REMEDIAL INVESTIGATION SUMMARY

2.1 PREVIOUS INVESTIGATIONS

From 1984 through 1989, the Los Angeles County Department of Health Services (LADHS) issued several Notices of Violation to the Cooper Drum Company as a result of incidents involving the release of hazardous substances at the Site. The LADHS required the Cooper Drum Company to conduct investigations of soil and groundwater. In 1989, the California Department of Health Services, now known as the Department of Toxic Substances Control (DTSC), also collected soil samples from under the DPA. The studies identified the following hazardous substances in soils at or near the Site:

- Tetrachloroethene (PCE) (a cleaning solvent)
- Trichloroethene (TCE) (a cleaning solvent)
- Dichloroethene (DCE) (a byproduct of TCE)
- Petroleum hydrocarbons
- PCBs
- PAHs
- Metals

Under direction of LADHS, consultants for the Cooper Drum Company excavated and removed contaminated soil from the property and from the adjacent Tweedy Elementary School, after caustic fluids leaked from trenches under the DPA building onto school property. To assess impacts to groundwater in the uppermost aquifer beneath the Site (approximately 40 to 80 feet below ground surface [bgs]), four monitoring wells were installed on site and one upgradient well was installed off site.

Groundwater beneath the Site was identified as contaminated with VOCs. In 1987, the City of South Gate closed four municipal water supply wells found to contain PCE. These wells are in South Gate Park, within 1,500 feet southwest of the site. At that time, the City listed the Cooper Drum Company as a possible source of the PCE contamination; however, recent investigations indicate that groundwater contamination found beneath the site did not contribute to the deeper groundwater contamination affecting those municipal wells. The groundwater contamination originating from the Site is moving to the south, not toward the municipal wells. It is confined to the upper aquifer and is not currently affecting any drinking water supplies in the City of South Gate because the municipal wells are completed in deeper aquifers.

The Tweedy School, on the adjacent property, was closed in 1988 because of the concern that children attending the school could be exposed to contamination migrating from the Site and from other industrial operations in the area.

Based on the discovery of the soil and groundwater contamination, EPA first proposed the Cooper Drum Company Site for inclusion on the NPL in 1992. EPA issued the General Notice and 104(e) letters to the Cooper Drum Company owners and operators at that time. During 1993, EPA met with Arthur Cooper, the site owner and previous operator (before Waymire Drum Company took over operations in 1992), who was considered a potentially responsible party (PRP). The purpose of the meeting was to discuss the special notice letter EPA was planning to send to him and to begin negotiations for an Administrative Order of Consent (AOC) to conduct the RI. Later that same year, the Cooper estate declared bankruptcy upon the death of Mr. Cooper. Given its lack of assets, the Cooper estate was no longer considered a viable PRP to help pay for the Cooper Drum Company investigation and remediation. Consequently, the Site became a fund-lead site, where Superfund trust fund money is used for site activities. Based on additional site investigation data collected by EPA, the Site was proposed for the NPL in January 2001. In June 2001, the EPA added the Site to the NPL of hazardous waste sites requiring remedial action.

EPA conducted the RI activities for Cooper Drum from 1996 to 2001. EPA initiated a soil gas survey in 1996 to identify potential hot spots (areas where contaminant concentrations of VOCs are the highest) for a Phase 1 RI. This investigation identified hot spots in the vicinity of the former HWA, in the northeastern portion of the property, and in the DPA, in the central portion of the property. The Phase 1 RI was designed to further investigate the potential presence of VOCs, semivolatile organic compounds (SVOCs), and metals in soil and groundwater beneath the Site and the adjacent Tweedy School property. Based on the results of the Phase 1 RI, EPA expanded its investigation of soil and groundwater to delineate the extent of contamination as part of a Phase 2 RI conducted between September 1998 and March 2001. The complete RI report, *Cooper Drum Remedial Investigation Feasibility Study Report* (the Site RI/FS) (URS, 2002) was released in May 2002.

The main hydrogeologic features penetrated by borings and wells completed during the RI field investigation include the Bellflower Aquiclude, the perched aquifer, the Gaspur Aquifer, and the Exposition Aquifer. These units constitute a shallow aquifer and a deeper aquifer. The shallow aquifer consists of the saturated portion of the Bellflower Aquiclude, which incorporates the perched aquifer (approximately 35 to 40 feet bgs), and the Gaspur Aquifer. The Bellflower Aquiclude extends to approximately 70 feet bgs, where it is underlain by the Gaspur Aquifer, which extends to approximately 110 to 120 feet bgs. The upper portion of the deeper aquifer system is represented by the Exposition Aquifer, which underlies the shallow aquifer. These hydrogeologic units are presented on generalized geologic cross-section B-B′ shown on Figure 2-1.

Nearby properties that also have undergone investigation as sources of groundwater contamination under the direction of the Los Angeles Regional Water Quality Control Board (RWQCB) include the Jervis Webb site (north of the Site) and two former Dial Corporation sites (northeast and east of the Site). Data from investigations at these three sites indicate that groundwater flows in a southerly direction. High concentrations of TCE in the shallow aquifer have been detected under the Jervis Webb site (33,000 parts per billion [ppb]) and in a downgradient monitoring well (6,700 ppb) 200 feet upgradient from and northeast of the Site. Given its proximity, the groundwater contamination from Jervis Webb may have commingled with and impacted the Cooper Site plume. To the southeast and further down gradient of the Cooper Drum plum is a fourth site (Seam Masters Site) that has shown high levels of TCE (up to 16,000 micrograms per liter [μg/L]). Based on investigation activities performed during the RD, groundwater contamination from the Seam Masters site has commingled with the downgradient (outside the property boundary) portion of the Cooper Drum Plume. The need to reduce commingling of these two plumes was an important consideration during the groundwater remedy selection.

The RI confirmed that waste collected in open concrete sumps and trenches resulted in releases to soil, and that migration of some of these contaminants impacted the shallow aquifer beneath the Site. The primary source of contamination was the HWA, where drum-processing operations took place until 1976, when they were moved to the DPA on the southern side of the property. The DPA also became a source of contamination as a result of chemical spills documented during the 1980s. Beginning in 1987, the Cooper Drum Company facilities were upgraded to prevent any further release of chemical wastes and to meet environmental regulations. The former HWA was closed and replaced with a new HWA in the DPA.

Site operations have resulted in the discharge of contaminants to the surface soil, vadose zone (i.e., unsaturated zone), and underlying groundwater. Although various chemicals have been released to the Site, VOCs are found in both the vadose zone and groundwater. VOCs and non-VOCs have been found in the vadose zone and surface soils.

The principal COCs identified in Site groundwater are 1,2,3-trichloropropane (TCP); TCE; and 1,2-dichloroethane (DCA) and a semivolatile compound, 1,4-dioxane. This compound was recently detected at the site (April 2004) after completion of the ROD in September 2002, and has consequently been incorporated into the RD. Eight other COCs identified in the RI/FS are vinyl chloride (VC); 1,2-dichloropropane (DCP); 1,1-DCA; cis-1,2-DCE; PCE; trans-1,2-DCE; 1,1-DCE; and benzene. The groundwater plume is characterized by high levels of cis-1,2-DCE and TCE. Arsenic and metals found in groundwater at concentrations exceeding drinking water standards are considered to be naturally occurring. Chemical property summaries for the key COCs are provided in Appendix A.

The principal VOC contaminants in the Site soil are the same 11 VOCs listed for groundwater. The non-VOCs in the soil are benzo(a)pyrene; PCBs (Aroclor-1260 and Aroclor-1254); lead; benzo(b)fluoranthene; dibenz(a,h)anthracene; benzo(a)anthracene; benzo(k)fluoranthene; chrysene; and indeno(1,2,3-cd) pyrene. Soil lead concentrations of 1,920 to 3,240 milligrams per kilogram (mg/kg) were detected in subsurface and surface soils. The soil COCs and their cleanup levels are listed in Table 2-1.

2.2 SUPPLEMENTAL RI DATA

The California DTSC agreed to the selected soil and groundwater remedies stated in the ROD, provided additional data were collected to address data gaps prior to implementation of the selected remedies. The EPA included the following components in the selected soil and groundwater remedies to address these concerns.

- Conduct additional soil gas sampling in the DPA and former HWA to further define the extent of non-VOC contamination and the need to excavate beyond the estimated 1,650 tons of soil. (The initial soil volume estimate was approximately 2,700 tons of soil. This number has been revised due to the limitation on the excavation depth, which will be required to be no greater than 5 feet bgs.)
- Conduct additional soil gas sampling in the DPA to further identify the extent of VOC contamination and the need for remediation using dual-phase extraction (DPE) in this area.

The RD supplemental sampling effort was completed between May 2003 and March 2006 and the results were presented in a technical memorandum (URS, 2006). A summary of the field sampling results, including conclusions and recommendations from the Technical Memorandum follows.

- The extent of non-VOC soil contamination is well defined in the former HWA. Based on perimeter sampling on the north side of the DPA building, PAH soil contamination is likely to be present beneath the drum processing building. Since it is not considered feasible to excavate beneath the building, institutional controls will be needed for this area. The volume of non-VOC-contaminated soil originally estimated in the ROD has changed from 2,700 tons, originally estimated, to approximately 1,650 tons presented in this RDR.

- The extent of VOC soil contamination is well defined in both the former HWA and DPA. Based on the RD soil gas sampling results for VOC contamination, in addition to the HWA, the DPA will also require remediation.
- The most significant discovery during the sampling effort was the presence of 1,4-dioxane in the site groundwater. It has been added to the Site COCs and will require the use of chemical oxidation as part of the groundwater remedy. 1,4-Dioxane was also detected in the perched aquifer beneath the HWA (up to 320 µg/L) and the DPA (up to 35 µg/L). This COC will be treated by an ex situ treatment system described in this RDR.

The chemical properties of 1,4-dioxane are provided in Appendix A.

The RD sampling effort sufficiently addressed the soil data gaps. The extent of non-VOC soil contamination was defined, and it was determined that the VOC soil contamination in the DPA would require remediation. Additionally soil sample results for 1,4-dioxane were well below the residential PRG of 44 mg/kg, such that this compound was not considered to be a COC for soil remediation. Data from the supplemental sampling effort, along with the RI data, have been incorporated into this RDR, as necessary. The data from the RD supplemental sampling efforts represent the most current data for the site, including soil, soil gas, and groundwater. For convenience, a complete set of the data tables, figures, and pertinent boring logs is included in Appendix B. Of particular interest are the non-VOC soil data, the soil gas data (including soil gas isoconcentration maps), and boring logs in the HWA and DPA. The figures showing the extent of non-VOC soil contamination and iso-concentration maps of soil gas contamination have been incorporated into Section 3.0 as a basis for the RD.

2.3 SUMMARY OF RECORD OF DECISION

The ROD for the Cooper Drum Site was signed on September 28, 2002. At the time, the known contaminants in groundwater consisted of VOCs only; therefore, the ROD did not make specific mention of 1,4-dioxane. However, by maintaining a comprehensive approach to cleanup, which employed the use of both in situ and ex situ technologies for cleanup and containment, the ROD-selected remedy for soil and groundwater remains viable for all Site COCs. The remedial action objectives (RAOs) for Cooper Drum, as stated in the ROD, are to protect human health and the environment from exposure to contaminated soil, groundwater, and indoor air, and to restore the groundwater to a potential beneficial use as a drinking water source. The ROD-selected remedy meets these RAOs through treatment of soil and groundwater contaminated with COCs.

2.3.1 Selected Action for Soil

The following paragraphs are excerpts from the Cooper Drum ROD:

- To remove the potential threat to human health, the selected remedy for soil will use DPE for treatment of VOCs in soil.
- Other non-VOC soil contaminants, including SVOCs, PCBs, and lead, will be excavated for disposal.

- Institutional controls will be implemented to prevent exposure to soil contaminants where excavation is not feasible.

EPA believes the selected remedy for Cooper Drum meets the threshold criteria and provides the best balance of tradeoffs among the alternatives considered. The EPA expects the selected remedy to satisfy the statutory requirements of CERCLA Section 121(b): (1) protection of human health and the environment; (2) compliance with applicable or relevant and appropriate requirements (ARARs); (3) cost effectiveness; (4) use of permanent solutions and alternative treatment technologies to the maximum extent practicable; and (5) use of treatment as a principal component.

2.3.2 Detailed Description of the ROD-Selected Remedy

The selected soil remedy components are as follows:

- In the former HWA, extract VOC-contaminated soil vapor and groundwater simultaneously using DPE technology. Treat the extracted soil vapor and groundwater using vapor and liquid phase carbon in vessels at an on-site treatment plant.
- After removal of VOCs, discharge the treated soil vapor into the air. The treated water will be re-injected into the aquifer or discharged to the public sewer system operated by the Los Angeles County Sanitation District.

The ROD indicated the total DPE remedial action duration is projected to be five years. Actual operation of the DPE system is estimated to be two years. It is assumed that vapor monitor wells and groundwater extraction well could continue to be sampled for at least three more years to ensure the remedial actions goals have been met.

Additional components of the soil remedy with respect to additional sampling to evaluate the need for use of DPE in the DPA and determine the extent of non-VOC contaminated soil for excavation are discussed in Section 2.2.

A final soil remedy component was as follows:

- Implement institutional controls for soil contaminated with non-VOCs in areas where excavation is not feasible, such as under existing structures, by requiring the execution and recording of a restrictive covenant which will limit activities that might expose the subsurface and would prevent future use, including residential, hospital, day care center and school uses, as long as contaminated soil remains on site.

Further detail on the objectives of the institutional controls and specific provisions the property owner must comply with are described in the ROD.

2.3.3 Rationale for the Selected Remedy

Five principal factors were considered in choosing the selected remedy for soil:

1. VOCs in soil are mobile but are low level threats to human health, since they exist at relatively low concentrations and can be contained.

2. DPE, an enhancement of the presumptive remedy of soil vapor extraction (SVE), can be used to simultaneously treat VOCs in soil and in the perched aquifer, which starts at about 35 feet bgs.
3. Excavation and disposal of shallow soil will be effective, because non-VOCs in shallow soil are not mobile and are localized in a confined area.
4. Use of institutional controls will eliminate/minimize the potential for exposure to any residual subsurface contamination.
5. The selected remedy is protective of human health and environment and complies with ARARs for VOCs and non-VOCs.

2.4 SUMMARY OF OU 1 GROUNDWATER REMEDY

The cleanup strategy for the groundwater (or shallow aquifer) contaminated with VOCs will use a combination of methods to achieve remedial goals and restore the potential beneficial use of the aquifer as a drinking water source. However, this RDR addresses only the dewatering of the perched groundwater in the area of the soil gas contamination to maximize soil cleanup of the COCs in the vadose zone. Selected remedies for the groundwater have been finalized and will be presented in the OU 1 (Groundwater) Remedial Design Report.

An enhanced reductive dechlorination (HRC) pilot-scale field treatability study was conducted in the main source area (HWA) from December 2003 through April 2005. The use of HRC led to the biodegradation of chlorinated ethenes; however, it was not successful in degrading 1,4-dioxane. EPA decided to evaluate in situ chemical oxidation (ISCO) technologies for the purpose of advanced treatment of all contaminants in the site groundwater. Based on the pilot test results, conducted from July 2005 through June 2006, the selected ISCO technology—ozone combined with hydrogen peroxide injection—will be selected as a source area in situ groundwater remedy, along with downgradient groundwater extraction for hydraulic containment of the plume's leading edge. An in situ permeable bioremediation barrier will also be used to expedite remediation of the portion of the plume (where 1,4-dioxane concentrations are lower) between the source area and downgradient containment extraction wells

2.5 COMPLIANCE WITH APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS (ARARS)

Remedial actions selected under CERCLA must comply with ARARs under federal environmental laws or under state environmental or facility siting laws, when those are more stringent than the federal requirements. The ARARs and to-be-considered (TBC) criteria identified in the ROD for the two soil remedies (excavation and DPE) are included in Appendix C.

If, after implementation of the remedy, hazardous waste still remains at the property at levels that are not suitable for unrestricted use of the land, additional institutional controls may be required in the form of a State Land Use Covenant with the property owner. The Covenant shall conform with the requirements of pursuant to Civil Code section 1471, Health and Safety Code section 25355.5 and the California Code of Regulations, title 22, section 67391.1.

A copy of the text for these regulations and a fact sheet for recorded land use covenants is also provided in Appendix C.

3.0 PROJECT APPROACH AND DESIGN OBJECTIVES

3.1 PROJECT APPROACH AND DESIGN OBJECTIVES

Based on previous site investigations, as summarized in Section 2.0, two zones will require soil remedial actions, including limited surface to near-surface soil removal for soils impacted with lead, PCBs, and PAHs and a deeper vadose zone RA for soils impacted with VOCs. The impacted areas for the HWA are shown on Figures 3-1 through 3-3 for PAHs, PCBs and lead, respectively. The impacted areas for the DPA are shown on Figures 3-4 and 3-5 for lead and PAHs, respectively. There are no PCB-impacted areas in the DPA. The cleanup levels for non-VOCs in the soil were presented in Table 2-1.

The vadose zone and underlying shallow aquifer is impacted in the HWA and DPA. The VOC impacts to the vadose zone in the HWA and DPA are depicted on Figures 3-6 through 3-20. These figures present isoconcentration maps for selected VOCs at depth intervals of approximately 10, 20, and 30 feet bgs. In regard to the impacted shallow groundwater at the Site, this document addresses treatment for the perched aquifer only. Groundwater treatment for the shallow aquifer is currently being finalized and will be discussed in greater detail in its own RDR.

RAOs for the Cooper Drum Site were established in the Site RI/FS and published in the Site ROD (EPA, 2002).

- Restore the groundwater to drinking water standards (maximum contaminant levels [MCLs]) for beneficial use.
- Remediate soil COCs (VOCs) to prevent contaminants from migrating into groundwater at levels that would exceed drinking water standards.
- Where feasible, remediate non-VOC-contaminated soil above health-based action levels that are protective of ongoing and potential future site uses.
- Remediate COCs (VOCs) in soil and groundwater to health-based action levels to eliminate potential exposures to indoor air contaminants created by Site contamination.

The remedial actions selected address impacted soil and groundwater and will meet these objectives.

3.2 DESIGN STRATEGY

This section details the design strategy and design for the three soil remedial actions to be implemented at the Site:

- SVE/DPE for subsurface contamination between the ground surface and approximately 50 feet bgs;
- Removal of the near-surface soils up to 5 feet bgs; and
- Institutional controls for impacted soils under existing buildings and greater than 5 feet bgs.

For simplicity purposes, these descriptions are divided by affected media: soil, soil vapor (gas), and perched groundwater. Institutional controls are used in areas of the Site for impacted media where buildings or areas are not easily accessible. As previously discussed, DPE will be performed prior to excavation of the shallow soils. The institutional controls will be implemented in conjunction with the DPE to prevent any exposure prior to the excavation of soils and continued after the excavation, as needed.

3.2.1 Soil Vapor

The chosen remedial alternative will be designed to efficiently promote the removal of volatile compounds from the soil particles and water film covering the unsaturated soil so that they can be carried advectively, under the influence of an applied vacuum, to the surface for collection and treatment. Extracted soil vapor will be treated at an on-site treatment system. The removal of VOC-impacts to soil from the Site will prevent its vertical migration at concentrations that would exceed drinking water standards. The task flow diagram for the SVE and DPE system design is shown on Figure 3-21. The design details for the deeper vadose zone soils and the perched aquifer remediation are provided in Section 5.0.

3.2.2 Soil

The chosen remedial alternative will be designed to remove Site subsurface soil that is impacted with Site COCs above cleanup levels, as detailed in Table 2-1. Removal of non-VOC COCs (e.g., lead) to the health-based cleanup levels will protect receptors at or near the site during ongoing and future activities. Institutional controls will be implemented for soil contaminated with non-VOCs in areas where excavation is infeasible, such as under existing structures or greater than 5 feet bgs. Design details for the near-surface soil remediation are provided in Section 4.0.

3.2.3 Perched Groundwater

The chosen remedial alternative will be designed to remove the affected perched groundwater to further reduce the migration of contaminants to the shallow aquifer in the future. Groundwater treatment for the shallow aquifer is not addressed in this report. A perched aquifer has been identified at the site beginning at approximately 35 feet bgs. The perched aquifer has been shown to contain high COC concentrations. Therefore, DPE will be used to dewater the perched aquifer to further expose the vadose zone and subsequently remove the COCs. It is possible, due to seasonal infiltration or other means, that once this perched zone has been dewatered and remediation has ceased, the perched zone may return to saturated conditions. It is anticipated the overall VOC mass will be reduced by DPE such that rebound concentrations in the perched aquifer are expected to be below action levels. Following are factors considered for employing DPE:

- The generally shallower occurrence (approximately 35 feet bgs) of the water table in the perched zone and the high concentrations of VOC contaminants present in this zone;
- The limited hydraulic connection between the perched aquifer and shallow aquifer (as indicated by the hydraulic head difference between the wells completed in the perched and shallow aquifers); and
- The possibility that the perched zone could be dewatered at generally low flow rates (less than 10 gallons per minute [gpm]) and treated.

In addition, as an incidental consequence of applying a vacuum as required with DPE or SVE, the water table rises under and around the DPE wells, a phenomenon called upwelling. Typically, upwelling occurs only as the SVE system is turned on or active. By sucking the DPE well dry, the ability of the system to extract contaminated soil gas increases in the deeper unsaturated zone because of drier conditions and the larger exposure of the screen area in the vadose zone.

Another option would be to remediate the perched aquifer at the same time the shallow aquifer is remediated. However, an in situ method, such as ISCO, may not be equally effective in both water-bearing zones given the localized and possibly seasonal nature of perched water and its low transmissivity. Pump and treat also may be less effective based on the limited hydraulic connection between the two zones. Therefore, the RD has included DPE in the HWA as the remedy, since there is a significant COC mass in the perched zone. Groundwater sample results in December 2003 from DPE-1 (in the HWA) showed the highest VOC concentrations (total VOCs greater than 2,200 µg/L) as compared to any monitor well completed in the shallow aquifer.

DPE will also be applied to the DPA. VOC concentrations in groundwater are much lower in this area of the site. Groundwater sample results from DPE-2 (in the DPA) show approximately 250 µg/L of total VOCs. This is consistent with monitor wells MW-1 (not detected), MW-4 (<50 µg/L total VOCs), and MW-22 (approximately 12 µg/L total VOCs) that are completed in the shallow aquifer around the DPA. However, soil gas concentrations remain high in the DPA, and SVE should be implemented there. By using SVE/DPE, extracting soil gas and any contaminated groundwater available in the perched aquifer, the overall site cleanup time can be shortened by not allowing VOCs in the vadose zone and perched aquifer to further impact the groundwater beneath the DPA. Groundwater analytical results from DPE-1 and DPE-2 are included in Appendix B.

4.0 DESIGN FOR SOIL REMOVAL ACTION

4.1 SITE SOIL DESIGN

Impacted soils will be excavated to remediate lead, PCB, and PAH contamination present in HWA and DPA subsurface soils at levels exceeding cleanup goals. This work will not be performed until after DPE remediation of the vadose zone and perched aquifer has been completed. In the meantime, institutional controls will prevent exposure to the contamination. The Site is currently covered with asphalt, preventing any direct worker exposure. Initial soil removal activities will consist of four excavation areas (two areas each in the HWA and DPA) to maximum depths ranging from 2 feet bgs to 5 feet bgs. It is not necessary to excavate beyond 5 feet, since the main concern for the near surface non-VOC contamination is direct exposure. For soils deeper than 5 feet, the ROD allows, "implementation of institutional controls for soil contaminated with non-VOCs in areas where excavation is not feasible, such as under existing structures." The following assumptions limit the excavation depth to 5 feet bgs:

- Any future construction trenching or foundation installation is not expected to exceed 5 feet.
- The vertical extent of PAHs and lead have been defined and it is unlikely that these contaminants will impact groundwater, provided an asphalt cap is in place and infiltration is negligible.
- Assuming excavation will remove contamination to 5 feet, there will be no direct exposure pathways after backfilling the excavation.
- Excavation below 5 feet is not cost-effective.
- Institutional controls (i.e., land use restrictions; see ROD page 55) would be put in place to alert any future construction events that may occur below 5 feet.

Confirmation soil samples will be collected at the excavation perimeter (the excavation walls and floor) to ensure that all impacted soils are removed from the Site. Confirmation sampling will follow the procedures prescribed in the Excavation Confirmation Sampling Plan (Section 4.3). The sampling plan will use the *Guidance on Surface Soil Cleanup at Hazardous Waste Sites: Implementing Cleanup Levels* (EPA, 2004). Pending the confirmation sampling analytical results, additional excavation of Site soils may be necessary. All excavated soils will be transported and disposed of at an approved off-site facility as detailed in the Transportation Plan (Section 4.5). All excavated areas shall be backfilled as detailed in the Excavation Work Plan, Appendix D. Institutional controls will be employed for soil contaminated with non-VOCs in areas where soil excavation is infeasible, as described above. Requirements for use of institutional controls in the form of land use covenants were referenced in Section 2.5. Detailed descriptions of the design assumptions, including excavation limits, for the design are provided in the following subsections.

4.2 PRIMARY EXCAVATION AREA AND VOLUME

Cleanup levels and the COCs that exceeded these levels at the Site are listed in Table 2-1. The initial excavation areas at the Site were delineated by comparing the concentrations of contaminants in soil samples collected during the previous site characterization activities to the cleanup levels. The Site cleanup levels will be further evaluated using recent EPA Guidance 9355.0-91 (EPA, 2004). Therefore, the cleanup levels listed in Table 2-1 may be redefined using an "area average." Results of this approach will be presented to all related parties for approval in the final confirmation soil sampling plan. The proposed initial excavation will be performed based on the hot spots identified by the cleanup levels in Table 2-1. The soils will be excavated in 1- to 2-foot intervals to the maximum depth of 5 feet. Areas outside of the initially identified hot spots will be excavated where confirmation sample results exceed the cleanup levels shown in Table 2-1 (or the re-evaluated cleanup levels), provided these areas are less than 5 feet deep and are outside Site structure boundaries. Sheet piling or other means of shoring may be used near Site structures or as needed. Shoring will be based on visual observations and geotechnical evaluations made during excavation. Areas with soil sample results that are less than cleanup levels, under Site structures, or in excess of 5 feet bgs will not be excavated.

Determination of the excavation area will include consideration of existing Site structures. Excavations will not require the demolition of existing structures; any subsurface soil contamination exceeding cleanup levels and underlying Site structures will not be excavated. Institutional controls will be enacted at the Site to limit exposure in these areas.

Based on previous site characterization activities, four areas (two each in the HWA and the DPA) have been delineated for primary excavation at depths ranging from 2 to 5 feet bgs. Areas delineated for excavation range from 1,200 to 5,100 square feet. Excavation limits are shown on Figures 4-1, 4-2, and Drawing C-2. These limits bound the soils that exceed soil cleanup levels. The initial excavation areas, depths, and volumes are summarized in Table 4-1. These two areas were determined using the criteria listed in Table 4-2. The excavation volume calculations are presented in Appendix E.

4.3 EXCAVATION CONFIRMATION FIELD SAMPLING PLAN

This field sampling plan (FSP) is presented as part of the Sample Analysis Plan (Appendix F). Confirmation sampling will be performed during primary excavation activities to ensure that soils with contamination levels exceeding the soil cleanup levels listed in Table 2-1 have been excavated. Confirmation samples will be collected from the excavation floors and walls. Along the excavation floor, soil samples will be collected on 20-foot centers, and sidewall samples will be collected at 40-foot intervals. Soil samples should also be collected on excavation perimeters to confirm that the surface contamination surrounding the excavation is below established cleanup levels (Table 2-1).

Sample Collection

Soil samples may be collected by one of the following methods:

- A spade-and-scoop method or, when the excavation does not allow for safe sampling by this method.
- Driving a stainless steel liner into soil contained in a backhoe bucket.

If the spade-and-scoop method is used, samples will be collected with a pre-cleaned or decontaminated stainless steel spade. The soil will be transferred into the appropriate sample container, secured, and properly labeled. If a stainless steel liner is used, the liner will be prepared for chemical analysis by covering the ends of the tube with Teflon sheeting and plastic end caps, and sealed with tape. The liner will be properly labeled and placed in a new resealable plastic bag. Samples collected by either method designated for laboratory analysis will be placed in an ice chest and kept cool (approximately 4 degrees Celsius [°C]) until they can be transported under chain-of-custody procedures to an analytical laboratory.

Sample Analysis

All confirmation soil samples collected during the removal action will be screened using field-screening methods for the COCs: lead, PAHs, and PCBs. Field-screening methods include a field-portable X-ray fluorescence (XRF) for lead and immunoassay test kits for PAHs and PCBs. The field immunoassay kits manufactured by SDI have the following minimum detection limits (DLs): 0.5 ppm for total PCBs and 0.2 ppm for PAHs as phenanthrene. Therefore, the minimum DL for total PCBs is less than the cleanup goal of 0.870 ppm which, per the Cooper Drum ROD, was back-calculated by applying residential exposure parameters used in the Site HHRA and a target health risk level of 1 in 100,000. The ROD also describes the cleanup level for PAHs in soil as being based on the upper tolerance limit background benzo(a)pyrene-toxicity equivalent (B(a)P-TE) concentration for the southern California PAH data set, which is 0.9 ppm B(a)P-TE. The immunoassay kit with the minimum DL of 0.2 ppm does not differentiate between phenanthrene and other PAHs. However, a table is provided that allows cross-referencing of the sample results with concentration equivalents for other PAHs. Additionally, the immunoassay kits are to be used as field screening tools, with 20% of the samples to be split and sent off for laboratory analysis.

4.4 STORAGE OF EXCAVATED MATERIAL AND SOIL PROFILE SAMPLING

All excavated material will be stockpiled on site in the areas designated in the Excavation Work Plan, presented in Appendix D. Under the State Water Resources Control Board General Permit for Discharges of Storm Water Associated with Construction Activity (Construction General Permit, 99-08-DWQ), a Storm Water Pollution Prevention Plan is required for projects involving 1 or more disturbed acres. However, the area being excavated at the site is less than 1 acre (0.22 acre or 9,575 square feet) and does not fall under these regulations. Precautions will be taken to prevent the migration of excavated material off Site. These will include placing stockpiles of excavated material onto one layer of polyethylene plastic sheeting and covering the stockpiles with polyethylene plastic sheeting. Berms will be constructed as necessary to divert runoff away from the stockpiles and to prevent the runoff from leaving the site or going to the Site drains.

Material from the four excavated areas may be kept separated for purposes of soil profiling. Soil profiling samples will be collected at an approximate interval of one sample per 150 cubic yards (cy) or as requested by the disposal facility.

4.5 TRANSPORTATION AND DISPOSAL OF EXCAVATED MATERIAL

This section was developed to provide details on the safety precautions taken to identify applicable permits, transportation routes, and transportation mechanisms from Cooper Drum to the appropriate off-site (Class I, Class II, or Class III) disposal facilities.

4.5.1 Soil and Concrete/Debris Transportation

After the soils have been characterized, the excavation subcontractor will load nonhazardous (e.g., Class II) contaminated soil and concrete/debris into end-dump trucks for transportation to the designated

Class II disposal facility (Appendix D). Any hazardous or Class I soil will be loaded into roll-off bins or trucks, manifested, and transported to the designated Class I disposal facility. Each truck will be decontaminated, and its load will be covered with plastic sheeting or tarpaulins and secured. Other measures that may be taken to prevent contaminated material from spreading off site during the loading process are: using water for dust suppression during loading activities, knocking off loose soil from trucks before leaving the Site, and washing down trucks and equipment before leaving the Site. Each load will then be inspected before leaving the decontamination area. Trucks will leave the Site by following the haul route presented in the following section. The truck will follow a route proceeding from the Site North on Rayo Ave, then East on Firestone Boulevard. This will take the trucks to Interstate 710.

4.5.2 Directions to Designated Disposal Facility

Prior to starting the excavation work, a disposal facility will need to be determined. At that time, detailed directions with a map will be provided to the hauling subcontractor.

4.6 SPILL RESPONSE

This section provides contingency measures to be employed in the event of spills and discharges that may occur during the handling and movement of potentially contaminated material (e.g., soil) and water. All trucking company employees have been trained to use the following procedures in responding to an accident or spill involving hazardous material.

- Approach the situation with extreme caution.
- Identify the hazards involved relative to:
  - Physical harm to people;
  - Assessing the physical damage;
  - Assessing the possibility of a release of hazardous waste; and
  - Identifying the hazardous waste involved by using information on the manifest.
- Contain the spill to prevent further spreading of the hazardous waste.
- Completely isolate the hazardous area.
- Evacuate all personnel from the hazardous area.
- Deny entry to anyone except emergency/rescue/response personnel (only after making all emergency response personnel fully aware of the hazard).
- Notify the proper emergency agencies (including Fire and Safety, Police, California Highway Patrol, and any other emergency agencies as appropriate).
- Contact the emergency phone number on the manifest to convey full details of the incident to the shipper.
- Contact the trucking company dispatcher and give full details of the incident.
  - The dispatcher will notify all government agencies involved in the transportation of the hazardous waste of the release or potential release of a hazardous substance.

- The trucking company will arrange for equipment to be mobilized to the site, and personnel will be dispatched or the driver on the scene will begin cleanup efforts.
- The trucking company safety coordinator will respond to the scene or will send a representative as soon as possible to direct the cleanup and will be the point of contact (POC) with all government agencies involved in the incident.
- The trucking company safety coordinator will file all appropriate information with all regulatory agencies involved.
- Drivers are instructed to give information only to emergency response personnel and not to any news media.

4.7 SITE RESTORATION

Clean backfill material will be obtained from an offsite source and will be sampled and analyzed to ensure compliance with the project specifications. Backfilling and grading will be accomplished to restore pre-excavation drainage characteristics at the Site. The soil will be compacted in a maximum of 6-inch lifts to 90% of the maximum dry density for cohesionless soils and to 85% of the maximum dry density for cohesive soils, based on the Modified Proctor Test (American Society for Testing and Materials [ASTM] D1557). A minimum of one density test will be performed per 6-inch compacted lift at each excavated area.

After the excavation is backfilled, the ground surface will be restored to its original condition, including asphalt patching of excavated areas. Pre-excavation grades will be maintained. Backfilling details and asphalt restoration details will be included on the project engineering drawings and the project specifications.

5.0 DESIGN FOR DPE REMEDIAL ACTION

5.1 DESIGN STRATEGY

One of the most effective soil treatment systems, which is in most cases, both technically and economically feasible for sites contaminated with VOCs, is vapor extraction using DPE and/or SVE. DPE is a system that extracts soil gas and groundwater simultaneously. The extracted soil gas and groundwater are passed through a treatment unit to remove the VOCs before they are released as exhaust to either the atmosphere (vapors) or re-injected into the shallow aquifer/discharged to sanitary sewer (water). This system is a proven technology and has historically shown very promising results in reducing soil and groundwater contamination to a point where environmental impact is no longer significant. The perched groundwater and condensate from the SVE will be treated along with influent from groundwater extraction wells for the OU 1 (groundwater) RA at an onsite treatment system. The effluent from this treatment system will be proportionally discharged to the Los Angeles County Sanitary District (LACSD) sanitary sewer and re-injected into the shallow aquifer.

5.1.1 Pilot Test Summary

The design for VOC removal in the vadose zone, using DPE in the former HWA and DPA, was based on pilot tests performed in the field at the Site. The testing objective was to evaluate the potential application of DPE/SVE technology to remediate contaminated soils beneath the Site. This test was conducted to determine soil air permeability and to estimate the radius of influence (ROI) of an SVE well. This information was needed to design an effective DPE/SVE system (e.g., to determine blower size, number of wells, and flow rates). Effective ROI depends on the rate of gas flow being extracted; the diameter of the well; subsurface material permeability; well screen thickness; and the soil type, moisture, and clay fraction.

SVE pilot tests were conducted in SVE-1 on January 3, 2001, and in SVE-2 on March 3, 2004. These well names have since been changed to DPE-1 and DPE-7, respectively, to reflect the dual-phase removal action. The SVE tests were performed using a trailer-mounted SVE system provided by Environmental Supply and permitted under the Southern California Air Quality Management District (SCAQMD). Vapor probes VP-1 and VP-2 were monitored during the SVE-1 test. Vapor probes VP-3 and VP-4 were monitored during the DPE-7 test. Vacuum response was measured using a Magnehelic pressure gauge connected to each vapor probe. A range of gauges was used to obtain more sensitive measurements. DPE-1 and DPE-7 wells were operated for three and four hours, respectively. Three and four influent air samples were obtained from DPE-1 and DPE-7 wells, respectively, for VOC analysis; the results are provided in Appendix G. Figure 5-1 shows the location of the wells used and cross-sections in the HWA and DPA. Figures 5-2 through 5-4 are lithologic cross-sections A-A′ through C-C′, which present the generalized geologic conditions in the areas of the two tests.

5.1.2 SVE Test Results

During the test, influent air samples were collected in Summa canisters for VOC analysis as the air stream entered the air emissions control system from the extraction well. Also during the test, vacuum readings at the extraction well and at nearby observation probes were recorded at three depths. Figures 5-5 and 5-6 illustrate and summarize observed vacuum responses, soil lithology, and relative distance from the SVE pilot test extraction well. Tables 5-1 and 5-2 summarize the air flow rates and vacuum measurement at the end of each test. Vacuum measurements collected during the tests are included on the field data sheets in Appendix G.

Estimates of soil permeability (k) and the ROI of vapor extraction wells are each fundamental to the design of a vapor well field for a vapor extraction system. On-site testing provides the most accurate estimate of k. Both k and ROI are used to space extraction wells and size the SVE system. Soil gas permeability, or intrinsic permeability, varies according to grain size, soil uniformity, porosity, and moisture content. The value of k is a physical soil property and is independent of extraction and injection rates. The DPE and SVE design methodology used two techniques to calculate and cross-check the DPE ROI in each area. These two methods included an empirical calculation method and a graphical method.

5.1.3 Methodology and Calculation of SVE ROI and Flow Rate

The ROI was calculated by two methods, graphically and empirically, to cross-check the results. The graphical method of calculating the ROI was determined using data from two SVE tests conducted at the Site on January 3, 2001, at well DPE-1 and on March 3, 2004, at well DPE-7. DPE-1 is in the HWA, and DPE-7 is in the DPA. The SVE wells and vapor probes or vapor monitoring wells were used to determine SVE well ROIs. Vacuum responses at three depths (10, 20, and 30 feet bgs) were recorded from four vapor monitoring wells (VP-1 through VP-4) located various distances from DPE-1 and DPE-7 (Figures 5-5 and 5-6). The ROI was determined by plotting vacuum response versus distance using the 10-foot and 30-foot depths from the two vapor monitoring wells located 25 feet and 45 feet from DPE-1. The high vacuum reading (at the 20-foot reading) at VP-2 was observed and not used; it may indicate a preferential flow pattern in this zone. The vacuum readings recorded from VP-3 and VP-4 could not be used to determine the ROI graphically because the two vapor monitoring wells were set at equal distances from DPE-7; this was a result of constraint caused by the location of SVE-2 within the DPA building. In determining the ROI, vacuum readings at each depth (i.e., 10 and 30 feet bgs) were plotted (Figures 5-7 and 5-8). These figures show that the best-fit line intersects the x-axis at about 52 to 60 feet for the 10-foot bgs and 30-foot bgs zones, respectively. It should be noted that a 0.1-inch of water (in. H_2O) line was used, which is the assumed minimum vacuum at which an acceptable level of influence for SVE will be effective. By averaging the ROIs (i.e., where the best-fit line intersects the x-axis), we estimated the overall ROI to be 55 feet. However, as the soils dry up, as a result of longer term DPE action, the ROI should improve.

The empirical method for calculating the ROI is presented here. Vacuum was applied to the DPE wells during the test until steady state conditions were observed. The criteria for "field steady-state conditions" were defined as stable vacuum readings on observation wells (until the vacuum response does not change by more than 10% over a 15-minute interval) and field-monitored vapor concentrations leveling off in value. Then vacuum readings at near steady-state condition were used to calculate the air permeability of the soils, using the following equation by Johnson et al. (1990):

$$\frac{Q}{H} = \pi \frac{k}{\mu} p_w \frac{\left[1 - (P_{ATM} / P_w)^2\right]}{\ln(R_w / Ri)}$$

Where:

k = permeability, Darcy

Q = air flow rate, cm^3/sec
μ = viscosity of air, centipoises
H = height of extraction well screen, feet
R_w = radius of vapor extraction well, cm
R_i = distance to monitoring well, cm
P_w = absolute pressure at vapor extraction well, atm
P_i = pressure at distance R_i

By using the following conversion factors:

472 cm^3/sec/cfm

30.48 cm/foot

406.8 in. H_2O/atmosphere

And rearranging the equation becomes:

$$kH \frac{\mu(406.8)\left(Q\, {cm3}/{sec}\right)\left(472 \frac{cfm}{cm3/sec}\right)(406.8-P_w)\ln\left(\frac{R_w}{R_i}\right)}{\Pi(30.48)\left[(406.8-P_w)^2-(406.8-P_i)^2\right]}$$

This equation was used to estimate the air permeability of the soils beneath the site. As shown in Tables 5-3 and 5-4, the air permeability of the soils is approximately 0.7 to 0.8 Darcy. The ROIs were calculated to range from approximately 31 feet (in one area) to 65 feet. This range agrees well with the ROI that was estimated graphically. Therefore, the design ROI chosen for these HWA and DPA sites is 55 feet.

5.1.4 Design Strategy

Results of the pilot test and calculations indicate that SVE is an appropriate choice for remediating the vadose zone soils in the HWA and DPA. The Site also exhibits a shallow perched aquifer, with high concentrations of COCs (see Section 3.2.3). Although partial cleanup of VOCs in the perched aquifer groundwater will be accomplished by operation of the SVE system for soil vapor remediation, we propose to use a groundwater recovery system to enhance the degraded water in the perched aquifer. A simple modification to the SVE wells and treatment system will be employed to remediate the shallow perched aquifer and speed up the removal of COCs from this area. This modification to these SVE wells will include using groundwater extraction pumps in the same extraction well for dual phase extraction of soil vapor and groundwater (DPE wells). The DPE will serve to lower the perched aquifer and expose more vadose zone soils impacted with COCs for extraction as soil vapor. Extracted groundwater will be conveyed to an on-site treatment system. The design for the DPE wells and treatment system follows.

5.2 VADOSE ZONE DESIGN

The vadose zone design evolved from the pilot test results and calculations summarized in Section 5.1. This design demonstrates a practical application of DPE technology to the HWA and DPA. System design calculations are included as Appendix H. These calculations determine the friction losses through the system in order to determine the SVE blower and individual submersible groundwater pumps.

DPE will be used to remediate VOC-impacted soil present in the vadose zone that is beyond the excavation limits, including under existing structures. The DPE system will require the installation of several DPE wells in the HWA and DPA areas of the Site. Extracted soil vapor will be treated using an on-site treatment system and discharged to the atmosphere. A detailed description of the design assumptions and the design for the SVE system is provided hereafter. Data obtained from SVE pilot tests were used to determine the well ROI and flow rates.

5.2.1 DPE Well Placement

Per the Cooper Drum ROD (EPA, 2002), the cleanup levels for VOCs in soil are to be determined (TBD) based on the remedial goals, which are:

- To prevent the vertical migration of leachate at concentrations that would impact the shallow aquifer at levels exceeding MCLs; and
- To ensure that residual VOC concentrations remaining in soil (after soil vapor extraction) are protective of potential indoor air receptors.

To evaluate attainment of these goals, performance evaluation soil gas samples will be collected during soil vapor extraction. The sampling results will then be used in the VLEACH model to evaluate impact to groundwater, and in the Johnson & Ettinger Model to estimate indoor air concentrations.

Although soil VOC cleanup levels are TBD, it was important to delineate an approximate area where soil vapor extraction would occur. Therefore, the cumulative 1,000 parts per billion by volume (ppbv) VOC isoconcentration contour, drawn based on soil gas samples from all depths, was used as a reasonable estimate for the horizontal and vertical extent of remedial action. The 1,000 ppbv contour is expected to be a conservative estimate of the extent of contamination that requires cleanup, because unless the contamination is right at the capillary fringe or just under the soil surface, soil gas concentrations less than this level are not likely to trigger model-predicted impacts greater than MCLs in groundwater, or greater than health risk levels in indoor air.

DPE well locations and ROIs (using the 55-foot ROI) were plotted on a site map showing the extent of soil vapor contamination exceeding 1,000 ppbv at 10, 20, and 30 feet bgs. Wells were placed to have overlapping ROIs and to encompass the 1,000 ppbv isoconcentration contour. This method confirmed that six wells would be required in the HWA and three wells, two of which are new, would be required in the DPA. The plots are shown as Figures 5-9 through 5-11 (HWA) and Figures 5-12 through 5-14 (DPA). The proposed well layouts were determined giving consideration to the use of existing SVE wells (used in the SVE test [SVE/DPE-1 and SVE-2/DPE-7]).

5.2.2 Design Flow Rates

Flow rates were recorded from the DPE wells (DPE-1 and DPE-7) during the SVE field test and these rates were used to determine a practical flow rate from each vapor extraction well. Field data collected during the SVE test are provided on Tables 5-1 and 5-2. Flow rates were plotted versus vacuum for the extraction well (Figure 5-15). It is assumed that a vacuum of 6 inches of mercury (in. Hg) or 82 in. H_2O is an acceptable wellhead vacuum for a typical SVE system. At this vacuum, the wells produced 47 cubic feet per minute (cfm). The total theoretical flow rate, if all wells are open, is estimated to be approximately 450 cfm. However, from a long-term operations and maintenance (O&M) perspective and based on site characteristics a more realistic design flow for the Site is 250 cfm. It has been shown to be more cost-effective to operate SVE and DPE systems at slightly lower flow rates at sites that contain finer grain soils, such as those found at this Site. In addition, at each boring location a well will be installed with two discrete screened intervals. This will allow control of the vadose zone removal action by extracting from a select interval to maximize mass removal based on soil characteristics and contamination concentrations. The deeper screened well will also be screened into the saturated zone of the perched aquifer. A submersible pump will be installed in the deeper well to extract groundwater as required.

The HWA airflow strategy is to use the original main extraction well, DPE-1. The airflow strategy in the DPA is to use the original main extraction well, DPE-7, with the other surrounding extraction wells operating in a phased approach. The DPE wells located in the most contaminated areas will be brought online to the treatment system first, and as system capacity allows, bring more wells online based on contaminant concentrations and mass removal rates.

As described above, Both the HWA and DPA extraction wells will operate in phases, with various combinations of extraction wells operating in each area. The target extraction rate per well is 50 standard cubic feet per minute (scfm). Each well will also be designed to operate as an extraction or air inlet well. The remediation system will include an air inlet valve for air dilution. Thus, the plant operators can control the extraction (ventilation) at the treatment compound to generate a ventilation rate of 50 cfm per well. The ventilation rate control features include a valve at the wellhead valve box to convert each well from an extraction well to an air inlet well, valves at the main pipe rack to the control panel to control the number of wells operating at any given time interval, and the automatic and manual air dilution valves for the system.

5.2.3 Basis of Design for DPE Wells and Treatment Compound

Following is a summary of the design inputs for the DPE wells.

- Ten-inch borehole/6-inch Schedule 40 polyvinyl chloride (PVC) well casings for the deep wells, depth-discriminate soil sampling and continuous well logging.
- Eight-inch borehole/4-inch Schedule 40 PVC well casings for the shallow wells, depth-discriminate soil sampling and continuous well logging.
- In the HWA, existing DPE-1 well will be used, screened between 8 and 43 feet bgs. Five additional double nested wells will be installed in HWA. In the DPA, DPE-7 will be used, screened between 8 and 48 feet bgs. Install two new double nested DPE wells. Wells will be referred to as DPE-3S through DPE-8S and DPE-3D through DPE-8D, where the "S" refers to shallow and the "D" refers to deep.
- The new DPE wells' shallow well will be installed to 32 feet bgs total depth and screened between 10 and 30 feet bgs. The deep nested well will be screened from 30 to 48 feet bgs, and have a total depth of 50 feet bgs.
- Vapor extraction rate of 50 scfm from each well (determined empirically from SVE test).
- Extraction well ROI of 55 feet as determined from SVE tests.
- In the deeper screened wells, a 0.5 horsepower (hp) submersible pump will be used in each new well yielding a 0.5 to 1.0 gpm water extraction rate per well.

- Soil gas concentrations detected during the SVE test:
  - Total VOCs, the sum of each speciated compound reported on the Method TO-14 analyses, range from approximately 440 parts per million by volume (ppmv) to 1,160 ppmv at SVE-1 and SVE-2, respectively, at the end of the pilot test. The samples contained PCE, TCE, fuel constituents and several breakdown products of chlorinated solvents. Analytical reports are presented in Appendix G as part of the Pilot Test Data.

Summary of DPE Treatment Compound (SVE and Groundwater Systems):

- For the SVE and ex situ groundwater treatment systems, a 25-foot by 30-foot concrete pad (6-inch slab with edge footing) with secondary containment will be constructed. It will be designed for Seismic Zone 4 and require approximately 120 feet exterior 8-foot chain-link fencing with vinyl security slats, one standard 12-foot gate, and one man gate.
- Electrical service and remote monitoring communication tied to existing local services. Existing power is approximately 600 A, 480 V. SVE requires approximately 100 to 200 A, 230V, depending on specific equipment. The groundwater equipment, discussed in greater detail in the groundwater basis of design (BDR), will require approximately 230A, 208V. A total of 330 to 430 A will be required for the complete remediation system, which includes the OU 2 treatment system discussed in the OU 2 BDR.
- Capacity of 250 cfm at 10 in. Hg, SVE blower with a knockout pot and catalytic oxidizer (CatOx), with a quench and acid gas scrubber air emission control (condensate to be sent to treatment system).
- Groundwater extracted as part of dual-phase operations will be sent to an equalization tank, then pumped into an ex situ ozone and hydrogen peroxide treatment system. Prior to discharge/re-injection, groundwater will be sent through two liquid-phase granular activated carbon (LGAC) vessels to remove any remaining contaminants to levels below discharge limits.

5.2.4 Basis of Design for Vapor Monitor Well Installation

This section identifies the locations for new vapor monitor well installations (referred to as vapor monitor points [VPs]) to evaluate the performance of the DPE wells. The design includes nine operating DPE wells. There are currently four VPs at the site: two are in the DPA and two are in the HWA. Extraction wells DPE-1 through DPE-6 together with the associated VP-1 and VP-2 are located within the HWA as shown in Drawing C-1. Extraction wells DPE-7, DPE-8, DPE-9 as well as the VP-3 and VP-4 are located in the DPA, also shown in Drawing C-1.

Thirteen VPs will be installed to monitor remediation activities and measure the clean-up progress at the site. VP-5 through VP-8 will be added to the DPA, and VP-9 through VP-17 will be added to the HWA.

The new VPs will provide access to more specific locations and depths and will allow measurement of the induced vacuum and collection of soil gas samples for analysis. The locations of the additional nine VPs in the HWA and four VPs in the DPA were chosen to characterize the two target zones.

A general design of a VP is shown on Drawing C-5. The VPs are placed downgradient and within the plumes to ensure full coverage. Table 5-5 provides a matrix showing the DPE wells and the relative distances to the VPs. Each DPE well will be monitored by at least two VPs within its ROI to monitor induced vacuum and trends in the plume.

In the HWA, one VP will be located within a distance of approximately 25 feet and the second VP will be located at a distance of approximately 50 feet relative to the DPE.

Since a concrete foundation, approximately 4 feet high and 35 feet wide, crosses the DPA, no VPs could be placed within this area. However, the locations of the new VPs are within the design limits and are not expected to compromise the new monitoring system.

5.3 PERCHED GROUNDWATER DESIGN

Groundwater extraction will be employed to dewater the perched aquifer (located at approximately 35 to 40 feet bgs), which over time will more fully expose the vadose zone and promote further removal volatilization of contaminants. Extracted groundwater will be pumped to the surface to the on-site treatment system and discharged, as discussed previously in Section 5.1. A detailed description of the design assumptions and the design for the groundwater extraction system is located in the OU 1 Groundwater RDR. Appendix I of this RDR presents a technical memorandum detailing results from a pump test performed on the perched aquifer. Section 5.5 presents some general concepts of the DPE well and treatment of the extracted groundwater

5.4 DETAILED DESIGN OF DUAL-PHASE EXTRACTION COMPONENTS

This section summarizes the DPE design details. Additional detail is provided in the O&M Guidelines provided in Appendix L of this RDR. Design highlights follow.

5.4.1 DPE Well Details

DPE well design features include the ability of these wells to extract vapor and liquid (groundwater) from the subsurface zone. The wells will include an electric submersible pump to remove groundwater and depress the perched zone, in an effort to continuously lower the perched water table in this area. This feature will allow more of the vadose zone to be exposed, thereby promoting more rapid removal of source area contamination and COCs dissolved in the soil pore water, and restoring the site effectively. The electrical supply line and the water discharge line will be contained within the well casing. At the surface, the wellhead in the vault box will be designed to allow the electrical line and the water line to penetrate the pipe wall without affecting the vacuum within the well.

In addition, the DPE wells will include a vertical "T" connection with a valve, so that these wells also can be modified at the vault box for conversion to an air inlet well. Ultimately, the operator will have a great deal of flexibility in the field to make modifications at the wellheads or at the vault box to control the ventilation rate and each well's function as a DPE well, an air inlet well, or an isolated well, shut off from the remediation system.

5.4.2 Blower Design and Selection

Blower design is based on the pilot test data and results as summarized in Section 5.1. The blower will be a positive displacement specified to produce approximately 10 inches vacuum of mercury. It will include a particulate filter, inlet and outlet silencers, and an acoustical sound enclosure to reduce the noise impacts to the surrounding neighbors. The blower design also will be specified to meet an explosion-proof classification (i.e., NEMA Class 1, Division 1). This will provide an extra level of safety for the operators and the public from the potential explosive mix of COCs at this site. Since the system is integrated, the CatOx manufacturer will specify the actual system blower. Sample blower curves and other treatment equipment are included as Appendix J.

The blower to be specified to the vendor will operate at 250 scfm and produce 10 inch Hg of vacuum.

5.4.3 Groundwater Extraction Pump Design

The deeper extraction well at each location will include groundwater extraction pumps. These pumps will continually depress the perched aquifer to further expose the vadose zone, promoting more rapid COC removal by vapor extraction. The pilot testing performed at the Site included groundwater extraction and subsequent measurements on the aquifer to properly size the groundwater extraction pumps.

Groundwater extraction pump design details are based on two short-term pumping tests (3 to 4 hours) performed on wells SVE/DPE-1 and SVE-2. Based on the two pumping tests, a design flow rate from each well is 0.5 to 1.0 gpm per well, for a total system flow rate of 4.0 to 8.0 gpm. The total depth of each well will be 50 feet bgs. A 2-foot sump will be included in each well design for placement of the extraction pump. The design screen interval is 30 to 45 feet bgs. A submersible pump controlled with a variable frequency drive will be used to achieve the low flows and prevent the well from running dry. Test results are summarized in the URS Technical Memorandum dated July 13, 2004 (URS, 2004; Appendix I)

5.4.4 Air Emission Controls

Based on the Site COCs, the contaminants being removed from the vadose zone will include chlorinated compounds. A CatOx vapor emission control unit has been selected for this application. In addition, a quench followed by an acid gas scrubber will be required to remove acid gases and prevent the production of dioxins and furans created by the oxidization of chlorinated compounds. An integrated system supplied by one vendor will be used.

CatOx was chosen as the emissions control system, based on soil gas and SVE test contaminant concentrations measured during the RI and related pilot testing. VOC concentrations (see Appendix G) are too high for vapor-phase carbon and too low for a thermal oxidizer to be efficient.

5.4.5 Extracted Groundwater Treatment

Based on the Site COCs, the contaminants being removed from the perched aquifer will include chlorinated compounds and 1,4-dioxane. The treatment technology selected for this application will be an advanced oxidation system combing in ozone and hydrogen peroxide to destroy the contaminants. LGAC vessels will follow the oxidation system to act as a polishing step prior to discharging treated groundwater.

5.4.6 Manifold and Piping Design

All extraction wells will have flow control valves at the wellhead and a "T" connection that will allow each well to also act as an air inlet well within the underground vault box. The DPE wells will be piped individually to the treatment system that conveys airflow to the treatment compound. The conveyance line will be sloped back to the extraction wells to prevent liquid blockage, in the event the vapor stream condenses in the lines. This design provides operational flexibility by allowing the operators to control flow and take measurements from each DPE well at the compound.

5.4.7 Treatment System Controls and Monitoring Points

The DPE monitoring systems will include the following components to promote safe and efficient remediation operations.

- *Vacuum Gauges* on each vapor inflow line and on the manifold headers.
- *Lower Explosive Limit (LEL) meter at the catalytic oxidizer.* If this LEL is exceeded, it usually indicates that the vapor mix is potentially too rich. When this condition occurs, the system will automatically add dilution air to lower the inlet concentration. If the dilution air valve is open 100% and inlet concentrations still exceed the LEL, the LEL meter will trigger a system shutdown.
- *Flow Rates* monitored via *pitot tubes, static pressure gauges, and temperature gauges* on each line. If the flow rates fall outside of the operating limits, headers may be blocked or plugged.
- *Temperature Switches* on the blower exhaust to monitor for safe operation. If this temperature is too high, it usually indicates motor problems or other upstream issue causing back-pressure on the blower. When temperatures exceed the high temperature set point, it will trigger a system shutdown. Temperature gauges will be included on the CatOx to monitor for safe operation. If the temperature is too high, it usually indicates CatOx problems, such as high inlet concentrations, and will trigger a system shutdown.
- *Pressure Switches* on the inlet and outlet side of the blower. If the pressures fall outside of the operating limits, the structural integrity of the pipe/equipment may be exceeded, which will trigger system shutdown.
- *An Hour Meter* to document system performance. It also will communicate to the controller so that the system can be monitored remotely to verify operation.
- *Tank Float Switches* at several locations to monitor key liquid levels in several tanks. The tanks include the "knock-out" pots for vapor condensate, the equalization tank for the extracted groundwater, the acid gas scrubber tank, the process tank, and the sump on the process pad. These switches monitor the low level, high level, and high/high level in the tanks. These level controls are used with the controller to call for more caustic or process water or to stop the flow into a tank. The high/high level float switch is used to shutdown the remediation system as a safeguard.
- *Flow Meters/Totalizers* at the discharge location to the sewer/injection well to monitor the total volume of groundwater discharged to each location.

Controls associated with the treatment systems are typically installed on the system by the manufacturer as part of a typical controls package. A review of the manufacturer's controls will be conducted prior to ordering to ensure all parameters are met to operate safely and continuously.

5.4.8 Instrumentation

The remediation system instrumentation and control (I&C) system assures that the system components operate correctly and efficiently. This coordination and control also provides for safety and security. The instrumentation designed for the Site remediation system will allow the system to operate with a high degree of automation and remote monitoring. The system employs three types of control: local control, centralized control, and remote control.

- Local control refers to the control of the valves at the wellheads for the DPE wells. These valves will not be automated at the field location.
- The centralized control refers to the control elements that will be located in the system compound. This control methodology allows the operator to control mechanical components (e.g., valves) and electrical components (e.g., switches) by hand in the compound. The centralized control methodology will have the greatest degree of control and override power of the three control methods.
- The remote control methodology will allow the operator (or others with the proper codes) to monitor the remediation and "stop" the system using the programmable logic controller (PLC).

Modems and telemetry will be employed to monitor and control the system. There also will be an auto-dialer to alert operating personnel of any malfunctions. These components, along with the PLC, will allow operators to monitor the system remotely.

The following instrumentation and process components are typical of what will be available on the remediation system:

- Pressure/vacuum gauges for each SVE well on the pipe rack in the compound
- Blower motor thermal overload switch
- Vacuum relief valve to secure blower shutdown
- Pressure and temperature monitors on the SVE lines
- High and low temperature shutoff at the air pollution control device
- Pressure relief valves at the blower inlet and outlet
- High liquid and high/high liquid shutdown in the groundwater surge tank
- High liquid and high/high liquid shutdown in the vapor knock-out drum
- Water flow totalizer and system run clocks
- Localized control panels and central control panel for the submersible groundwater pumps

The remediation system operators also will have other portable monitoring equipment and tools for proper system adjustment and operation.

5.4.9 Electrical Controls

The electrical equipment will be designed and selected in accordance with the classification of the various areas of the remediation system. In accordance with the National Electrical Code (NEC), and considering the mixture of vapors the system will handle at the Site, the system is assumed to require Class 1, Division 1, electrical components, especially given that the system will be remotely monitored and managed by operating personnel only 1 to 3 times per month. Class 1, Division 1-specified components are designed to operate in atmospheres with potentially explosive or flammable vapors.

The motors for the system will be specified to be totally enclosed, fan-cooled (TEFC) as well as explosion-proof. The motors also will be rated "T," as defined by the NEC, and comply with the National Fire Protection Association (NFPA) 497M (or latest equivalent) to produce lower temperatures on the external housing, to comply with the Class 1, Division 1, criteria.

Other electrical components will be specified to operate under outdoor weather conditions for this area in California. The electrical panel will include safety components, such as breakers and electrical grounding. There will be an emergency shut-off switch inside the compound. The remediation system will be lighted at night for security and safety.

5.4.10 Process Safety Checklist

In addition to the mechanical controls, which provide safe operation, mentioned above, the system design will specify that the remediation system include the following key process safety features.

- An O&M manual for pertinent equipment;
- A clearly marked emergency shut-off switch in the treatment compound area;
- NFPA warning signs and placards on the security fence;
- Emergency contact names and phone numbers on the security fence;
- Security fencing and lighting;
- Spill prevention and containment cabinet;
- First aid kit;
- Clearly marked directional flow arrows on the process piping;
- Fire extinguisher; and
- Other safety components, as required.

A process safety review will be accomplished as an expanded component of the quality assurance (QA) review that is standard procedure for URS design projects.

The deliverable product resulting from this effort will be a checklist that demonstrates compliance with ARARs and pertinent codes and standards for the project remediation system. This checklist will be a living document that follows the development of the design to the "final" stage and into system installation. It is currently anticipated that approximately one page of text may be incorporated into the process flow diagram (PFD) to record the revision number, date, and initials of the reviewing engineer.

5.5 DESIGN ASSUMPTIONS FOR DPE SYSTEM OPERATION

The overall treatment process is DPE. The single treatment compound will be centrally located to minimize trenching and materials. The compound will be capable of treating up to 250 scfm of COC-laden vapor streams and up to 10 gpm of perched groundwater and condensate from the vapor streams.

5.5.1 VOC Mass Estimates to Cleanup

From previous VLEACH model runs, mass estimates of the contamination were calculated for both the HWA and DPA. At the HWA, approximately 2,900 pounds is estimated to be in the vadose zone. In the DPA, roughly 1,100 pounds of VOCs is estimated. Many of the parameters in the mass calculation are estimates or have a range of possible values, adding additional uncertainty to the estimate. However, this mass calculation should not be construed as the exact amount of contamination to be removed from the site.

During the SVE test, DPE-1 (located in the HWA) and DPE-7 (located in the DPA) were able to produce 9.5 pounds per day (lb/day) and 4.7 lb/day, respectively. These removal rates are likely the maximum extraction rates to be expected. As the DPE system extracts mass from the vadose zone, the mass removal rate will decrease. The rate at which the removal rate declines depends on a variety of subsurface variables, such as the relationship between soil air permeabilities, the location of contamination in the vadose zone, and the location of the extraction well to the contamination in the specific geologic formation and its ability to effectively volatilize the contaminants. As the DPE RA progresses, the monitoring and performance data collected will be used to optimize the treatment system and expedite Site cleanup. An estimate for this site, based on other Superfund sites across the country, the expected time to reach cleanup goals would be approximately three years, but depending on subsurface conditions could take as long as 10 years.

5.5.2 System Performance Sampling

System samples will be required during system startup and operations to ensure proper operation of the proposed remediation equipment. A detailed summary of the proposed sample schedule is presented in Table 5-6. The sampling frequency and parameters are typical for DPE systems. The system inlet and outlet will need to be monitored for VOCs, as well as for other emissions criteria, such as acid gas emissions produced during the oxidation of chlorinated compounds, to ensure proper operation. The Permit to Operate issued by the South Coast Air Quality Management District, Los Angeles County Sanitation District permit and/or Los Angeles RWQCB Waste Discharge Requirement (WDR) permits may require additional parameters and monitoring frequency. The permits will determine the actual sampling frequencies, parameters, and analytical methods. The two later permits will be obtained under the OU 1 (groundwater) RA.

The system operators, with the help of the design engineers, will monitor long-term system performance. Key parameters, such as mass removals, discharge limitations, and run time efficiency, will be tracked and monitored. This data will allow for a complete review, and remedial process optimization (RPO) reviews will be implemented when necessary. As part of the RPO evaluation a recommendation for switching off the emission controls system from CatOx to vapor granular activated carbon (VGAC) should be made as influent concentrations fall below approximately 150 ppmv.

5.5.3 Post-Remediation Confirmation Compliance Monitoring

Once contaminant concentrations have reached target cleanup levels or concentrations shown not to further impact groundwater above cleanup goals, the system will be turned off. This shutdown will allow for any potential rebound in the perched aquifer and vadose zone to occur. During this time, quarterly well sampling events will be conducted for six months to 1 year, to confirm the site is clean or if concentrations have rebounded to levels above the cleanup goals. The confirmation sampling will include at least one sample from each extraction and monitoring well. If results show evidence of rebound the system will be restarted. If concentrations remain below target cleanup levels, the Site will be recommended for closure sampling. Closure sampling will include the collection of soil gas samples at areas that were previously impacted and should have been remediated by the Removal Action. Step-out sample locations from these initial closure sample locations may be required by the Regulatory Agencies to demonstrate complete remediation of the site for closure.

5.6 TREATMENT PROCESS OPERATION DETAILS

The performance standards focus on these objectives:

1. Operator and personnel safety
2. Process efficiency with zero incidents
3. Cost effectiveness

The remediation system design will incorporate mechanical and electrical safeguards. Operator training, safety consciousness, and experience will be required for safe operation. The remediation system will include design flexibility to maximize process efficiency. Operator training, along with engineering technical services, will be required to meet the second objective of process efficiency with zero incidents. Accomplishing the first two objectives listed above, along with maximizing run time, will help achieve the third objective, cost effectiveness.

5.6.1 Media, Byproducts, and Process Rates

The media extracted from the HWA and DPA (soil vapor and perched groundwater) contain COCs. One recent addition to the COCs for the groundwater is 1,4-dioxane, which has been found in the last two groundwater monitoring rounds at concentrations ranging from 69 µg/L to 700 µg/L.

The anticipated flow rates from the DPE system will be approximately 5 to 10 gpm. This flow will be combined with the liquid generated from the caustic gas scrubber, for a maximum design rate of 12 gpm. The byproducts from the liquid treatment system will be treated water that meets the discharge requirements and spent LGAC.

The anticipated airflow from the DPE blower will be approximately 250 scfm. The byproducts from the catalytic oxidizer with the acid scrubbing process will be carbon dioxide discharged to the atmosphere and spent scrubber slurry (slightly basic) discharged to the sewer.

5.6.2 Waste Streams

Local Sanitary Sewer District

The discharge to the LACSD sanitary sewer has a maximum design rate of approximately 40 gpm. The quality discharge limitations for flow rates, temperature, pH, total dissolved solids (TDS), select metals, and volatile organics will be monitored and controlled carefully.

South Coast Air Quality Management District

The discharge to the atmosphere has a maximum design rate of approximately 300 scfm. The quality discharge limitations for flow rates, particulates, and volatile organics will be monitored and controlled carefully, and will meet South Coast Air Quality Management District requirements.

Granular-Activated Carbon

The granular activated carbon (GAC) will be selected, handled, and disposed of with the assistance of a pre-qualified carbon vendor. The plant operators will supervise the carbon changeouts. After changeout, the carbon vendor will perform the actual carbon removal and regeneration for future use or disposal to a licensed landfill.

5.6.3 Project Quality Checklist, Pertinent Codes, and Standards

The Project Quality Checklist includes a section on Process Safety, ARARs, Pertinent Codes, and Standards. This checklist is a living document that will follow the development of the design to the "final" stage and into installation. The checklist is currently anticipated to consist of approximately one page of text that may be incorporated into the PFD engineering drawing. It will also record the revision number, date, and initials of the reviewing engineer.

5.6.4 Other Technical Factors

As other technical factors that become apparent regarding the remediation system design or O&M, this RDR will be revised and recorded, as appropriate. All revisions to this RDR and/or engineering drawings must be approved in advance by EPA Region IX.

6.0 CONSTRUCTION AND IMPLEMENTATION

6.1 PLANS

The following plans must be provided before implementation of the RA

The Remedial Action Work Plan (RAWP) identifies construction and implementation issues to be carried out by the remedial action contractor. The RAWP will include a Site Health and Safety Plan (HASP), Sampling and Analysis Plan (SAP), and the Construction Quality Control Plan (CQCP).

A generalized CQCP has been included as Appendix K of this RDR. The RAWP, HASP, and SAP will be prepared by the remedial action contractor. The CQCP is intended to establish project organization and includes requirements for independent evaluation of the construction conformance to the design specifications. A draft SAP has also been prepared for the soil excavation and is provided in Appendix F.

A Construction Completion Report will be prepared by the construction contractor that includes discussion of field design changes, as-builts, quality control results, and health and safety documentation.

A generalized O&M manual for the DPE system has been included as Appendix L of this RDR; however, a more specific O&M manual, which includes system and vendor specific guidelines must be provided by the construction contractor. The O&M manual will be provided in conjunction with the RAWP. The O&M manual will include: (1) a description of the treatment system operation, (2) a description of potential operating problems and solutions, (3) specifications and maintenance schedules for all equipment.

6.2 DESIGN DRAWINGS

A full set of design drawings are attached in this volume of the RDR (Volume I). These design drawings for the RA have been previously referenced in prior sections of this report

6.3 SPECIFICATIONS

Complete specifications for the remedial action are provided in Volume III of this RDR and are intended to accompany the Drawings package for use in the field during construction.

6.4 SCHEDULE

A remedial action schedule is also included in this volume of the RDR (Volume I). The schedule includes both the OU 1 groundwater and OU 2 soil RA. Because a start date for the RA has not been determined, the schedule is based on days to complete each task following start of construction activities.

6.5 COST ESTIMATE

A remedial action cost estimate has been prepared based on the design presented herein and is provided in this volume of the RDR (Volume I). The cost estimate was prepared using prior experience and actual subcontractor bids. The cost estimate is expected to be within plus 15% and minus 5 percent.

The total estimated capital cost for the soil RA is approximately $2,201,000. This estimate assumes that construction of the RA occurs in the first year (i.e., capital costs are not inflated or discounted). This cost estimate includes the installation cost for the groundwater remediation equipment because extracted water from the perched aquifer will be treated as part of the soil RA.

The total present worth O&M cost is estimated at $836,000. This estimate accounts for inflation, as well as a discount rate of 7%, over the 3-year duration of the project. The cost associated with O&M of the groundwater treatment equipment is included in this estimate.

Based on these estimates of the capital and the present worth O&M costs, the total cost for implementation of the soil RA is approximately $3,037,000 in 2007 dollars.

6.6 CONTRACTOR QUALIFICATIONS

The contractor shall have three to five years experience with soil and groundwater remediation systems, piping systems, and excavation of remedial sites. The contractor will be responsible for the quality performance of work specified and preparation of products and reports required for completion of installation of systems. The contractor will also manage all solid wastes generated during construction and excavation of the site, including sampling and disposal of wastes. The contractor will provide technical and administrative services, monitor, supervise, review work performed, coordinate budgeting and scheduling to assure that the project is completed within budget, on schedule, and in accordance with approved procedures and applicable laws and regulations. All employees or subcontractors performing work on this site will be 40-hour trained under Code of Federal Regulations (CFR) 1910.120 and California Code of Regulations (CCR) Title 8-5192. The contractor shall be bonded and licensed in the state of California, providing references and descriptions of previous related work. The contractor will identify the potential physical and chemical hazards that may be encountered, and will specify health and safety control measures to be implemented throughout the course of the project.

6.7 COOPER DRUM PROPERTY SITE ACCESS

The area of the Cooper Drum property where remediation equipment will be installed must be vacated and secured during the RA. This will enable safety and prevent exposure to hazardous substances during installation and operation of the remedial systems.

6.8 OFF-SITE EASEMENT AND ACCESS

Since the Cooper Drum Site is bordered between Coryal Street and Rayo Avenue, with downgradiant extraction wells located on McCallum Avenue and additional monitoring wells to be located between Southern Avenue and McCallum Avenue, it is expected that the contractor will gain required permits, easements, and rights of way to access properties and/or public areas. The contractor will need to prepare traffic plans, and schedule traffic controls prior to the start of work, taking into consideration delays and restrictions in the work schedule to accommodate possible delays due to weather, traffic, and easement and access restrictions.

7.0 ENVIRONMENTAL AND PUBLIC IMPACT REDUCTION PLAN

The overall remediation system will be designed and constructed with the objective of reducing environmental and public impacts. As stated in Section 5.0, the system operation objectives will be to achieve:

- Operator and personnel safety
- Process efficiency with zero incidents
- Cost-effectiveness

These objectives will contribute to promoting little or no impact on the environment and the public. In addition, the remediation system will include security, electrical grounding, visual impact reduction, security fencing, and spill containment. This section details these additional environmental and public impact reduction plans.

7.1 SECURITY AND FENCING

System security features include automatic alarm settings on the process equipment and corresponding automatic notification to the responsible system operators. In addition, the system will include dusk-to-dawn lighting and automatic electrical shut-offs, in the event vandals tamper with the equipment and cause an auto-trip alarm. The system will include 8-foot chain-link fencing with lockable gates for entry and exit, and security slats that will block the view of the process equipment to reduce public curiosity.

7.2 ELECTRICAL GROUNDING

The remediation system will be designed and installed with electrical grounding to reduce the potential for operator electrocution. Electrical grounding is also required because this system will process impacted groundwater. Noise abatement features will be included on the key pieces of process equipment.

7.3 VISUAL SCREENING

The security fencing will be installed with colored slats in the chain link for visual screening. This type of fencing is very durable, secure, and suitable for this type of application. The screening should reduce complaints approximately visual concerns from local residents.

7.4 SPILL CONTAINMENT

The remediation system will be constructed on a concrete pad with spill containment features. The containment sump will include an alarm feature that will be tied into an automatic interlock for system shutdown.

8.0 REFERENCES

Johnson, P., C. Stanley, M. Kemblowski, D. Byers, J. Colhart, 1990. A Practical Approach to the Design, Operation, and Monitoring of In Situ Soil Venting Systems. *Ground Water Monitoring Review*, p. 163, Eq. 5. Spring.

United States Environmental Protection Agency (EPA), 2002. *Record of Decision, Cooper Drum Company, City of Southgate, California.*

EPA, 2004. *Guidance on Surface Soil Cleanup at Hazardous Waste Sites: Implementing Cleanup Levels.* May.

URS Group, Inc. (URS), 2002. *Cooper Drum Remedial Investigation Feasibility Study Report.*

URS, 2004. *Cooper Drum Superfund Site Remedial Design Supplemental Field Sampling Results Technical Memorandum.* April.

URS, 2006. *Cooper Drum Superfund Site Remedial Design Technical Memorandum for Field Sampling Results.* July.

TABLES

TABLE 2-1

Cleanup Levels for Contaminants of Concern

Medium	Contaminant of Concern	Cleanup Level	Basis for Cleanup Level	Risk at Cleanup Level
Soil (VOCs)	1,1-Dichloroethane (1,1-DCA)	Leachate <MCL[a]	VLEACH modeling	TBD
	1,1-Dichloroethene (1,1-DCE)	Leachate <MCL	VLEACH modeling	TBD
	1,2-Dichloroethane (1,2-DCA)	Leachate <MCL	VLEACH modeling	TBD
	1,2-Dichloropropane (1,2-DCP)	Leachate <MCL	VLEACH modeling	TBD
	1,2,3-Trichloropropane (1,2,3-TCP)	Leachate <PQL	VLEACH modeling	TBD
	Benzene	Leachate <MCL	VLEACH modeling	TBD
	cis-1,2-Dichloroethene (cis-1,2-DCE)	Leachate <MCL	VLEACH modeling	TBD
	trans-1,2-Dichloroethene (trans-1,2-DCE)	Leachate <MCL	VLEACH modeling	TBD
	Tetrachloroethene (PCE)	Leachate <MCL	VLEACH modeling	TBD
	Trichloroethene (TCE)	Leachate <MCL	VLEACH modeling	TBD
	Vinyl chloride	Leachate <MCL	VLEACH modeling	TBD
Soil (nonVOCs)	Aroclor-1254	870 μg/kg	Human health hazard	1 e-05
	Aroclor-1260	870 μg/kg	Human health hazard	1 e-05
	B (a)P-TE [b] – Benzo(a)anthracene – Benzo(a)pyrene – Benzo(b)fluoranthene – Benzo(k)fluoranthene – Chrysene – Dibenz(a,h)anthracene – Indeno(1,2,3-cd)pyrene	900 μg/kg	Background	Background
	Lead	400 mg/kg	Human health hazard	IEUBK Model
Groundwater (VOCs)	1,1-Dichloroethane (1,1-DCA)	5 μg/L	MCL	Cancer risk at 2.6e-06
	1,1-Dichloroethene (1,1-DCE)	6 μg/L	MCL	HI = 0.04
	1,2-Dichloroethane (1,2-DCA)	0.5 μg/L	MCL	Cancer risk at 4.0e-06
	1,2-Dichloropropane (1,2-DCP)	5 μg/L	MCL	Cancer risk at 3.1e-05
	1,2,3-Trichloropropane (1,2,3-TCP)	1 μg/L	PQL [c]	Cancer risk at 6.2e-04
	Benzene	1 μg/L	MCL	Cancer risk at 9.0e-06
	cis-1,2-Dichloroethene (cis-1,2-DCE)	6 μg/L	MCL	HI = 0.23
	trans-1,2-Dichloroethene (trans-1,2-DCE)	10 μg/L	MCL	HI = 0.19
	Tetrachloroethene (PCE)	5 μg/L	MCL	Cancer risk at 1.2e-05
	Trichloroethene (TCE)	5 μg/L	MCL	Cancer risk at 4.9e-06
	Vinyl chloride	0.5 μg/L	MCL	Cancer risk at 2.2e-05
Groundwater (SVOCs)	1,4-Dioxane	6.1 μg/L	PRG[d]	TBD

TABLE 2-1

(Continued)

[a] MCLs from Title 22 California Code of Regulation Section 64431 and 64444 unless otherwise specified.
[b] Based on upper tolerance limit (UTL) background benzo(a)pyrene-toxicity equivalent (B(a)P-TE) concentration for southern California PAH data set.
[c] No MCL established for 1,2,3-trichloropropane. The PQL was identified as a remedial goal for 1,2,3-trichloropropane.
[d] Cleanup action level will be reassessed and any revisions will be incorporated into the remedial action.

HI	=	hazard index
IEUBK Model	=	Integrated Exposure Uptake Model for Lead in Children
MCL	=	California primary maximum contaminant level
PRG	=	preliminary remediation goal
PQL	=	Practical quantification limit
SVOC	=	semivolatile organic compound
TBD	=	to be determined
VOC	=	volatile organic compound
µg/L	=	micrograms per liter
µg/kg	=	micrograms per kilogram

TABLE 4-1

Summary of Excavation Areas

Site Area	Excavation Area	COCs Exceeding Cleanup Levels	Area (sq ft)	Depth (ft)	Volume (cu yd)
Drum Processing Area	West (#1)	PAHs	2,475	2.5	229.2
Drum Processing Area	West (#2)	PAHs	900	5.0	166.7
Drum Processing Area	East (#1)	PAHs	300	5.0	55.5
Drum Processing Area	East (#2)	Lead, PAHs	1,700	5.0	314.8
Former Hard-Wash Area	West	Lead	1,200	2.5	111.1
Former Hard-Wash Area	East	Lead, PCBs	3,000	2.5	277.8
				Total Volume of Excavated Soil	1,155
				Soil Expansion (fluff) 10%	116
				Total	1,271

COC = contaminant of concern
cu yd = cubic yard
ft = feet
PAH = polycyclic aromatic hydrocarbon
PCB = polychlorinated biphenyl
sq ft = square feet

TABLE 4-2

Design Assumptions for Soil Removal Action

Non-VOC COCs: PCBs, PAHs, and lead.
Initial excavation limits determined from previous site investigations including May 2003.
Site consists of sandy silts interspersed with layers of clay.
Two excavation areas and depths each in the former HWA and DPA.
HWA west excavation summary:
– Surface area: 30 feet by 40 feet
– Excavation depth: 2.5 feet bgs
– Excavation area is covered with asphalt
– Estimated volume: 111 cubic yards
HWA east excavation summary:
– Surface area: 60 feet by 50 feet
– Excavation depth: 2.5 feet bgs
– Excavation area is covered with asphalt
– Estimated volume: 279 cubic yards
DPA west excavation summary:
– Surface area: 65 feet by 60 feet
– Excavation depth: 2.5 feet and 5.0 feet bgs
– Excavation requires shoring for depths greater than 4 feet bgs, or as identified by Competent Person
– Excavation area is covered with asphalt
– Estimated volume: 395 cubic yards
DPA east excavation summary:
– Surface area: 80 feet by 25 feet
– Excavation depth: 5 feet bgs
– Excavation requires shoring for depths greater than 4 feet bgs, or as identified by Competent Person
– Excavation area is covered with asphalt
– Estimated volume: 370 cubic yards
Total volume of soil (approximate): 1,271 cubic yards
Soil mass 1,653 tons (assuming 1.3 tons/cubic yard)
Confirmation samples to be collected as per the Confirmation Sampling Plan: along the excavation floor on 20-foot centers and on sidewalls every 40 feet below the zone of contamination.
Excavated material to be stockpiled on site. Profile sampling for off-site landfill disposal to be taken at approximate frequency of one sample for 150 cubic yards, or as required by the landfill.
Transport excavated material off site to appropriate landfill.

bgs = below ground surface
COC = contaminant of concern
DPA = Drum Processing Area
HWA = Hard-Wash Area
PAH = polycyclic aromatic hydrocarbon
PCB = polychlorinated biphenyl
VOC = volatile organic compound

TABLE 5-1

DPE-1 Test Data

Well Name	DPE-1	VP-1 10 feet	VP-1 20 feet	VP-1 30 feet	VP-2 10 feet	VP-2 20 feet	VP-2 30 feet	
Distance from SVE (feet)	–	20	20	20	45	45	45	
Screen Interval (feet bgs)	8–43	9.5–10	19.5–20	29.5–30	9.5–10	19.5–20	29.5–30	
Flow rate (cfm)	Vacuum (in. H_2O)	Vacuum (in. H_2O)	Vacuum (in. H_2O)	Vacuum (in. H_2O)	Vacuum (in. H_2O)	Vacuum (in. H_2O)	Vacuum (in. H_2O)	Elapsed Time
22	30	0	0.3–0.7	0.6–1.1	0.2	0.8–1.5	0	30 min.
53	65	0.1	0.7–0.9	1.5–3.3	0.3–0.5	1.6–3.2	0.4–0.9[a]	65 min.
88–98	130	3.5[a]	2.3–5.0	4.5	0.9	5–10	2.0–3.2	180 min.

[a] Changed gauge.

bgs = below ground surface
cfm = cubic feet per minute
DPE = dual-phase extraction
in. H_2O = inches of water
SVE = soil vapor extraction
VP = vapor point

Note: Vapor samples collected from DPE-1 at 10, 90, and 180 minutes (shutdown).

TABLE 5-2

DPE-7 Test Data

Well Name	DPE-7	VP-3 10 ft bgs	VP-3 20 ft bgs	VP-3 30 ft bgs	VP-4 10 ft bgs	VP-4 20 ft bgs	VP-4 30 ft bgs	
Distance from SVE (feet)	–	50	50	50	50	50	50	
Screen Interval (feet bgs)	8–48	9.5–10	19.5–20	29.5–30	9.5–10	19.5–20	29.5–30	
Flow rate (cfm)	Vacuum (in H_2O)	Vacuum (in H_2O)	Vacuum (in H_2O)	Vacuum (in H_2O)	Vacuum (in H_2O)	Vacuum (in H_2O)	Vacuum (in H_2O)	Elapsed Time
24.5	40	0.3–0.6	0.65–0.7	0.7–1.15	0.17–0.2	0.45–0.85	0.67–1.1	40 min.
45.8	80	0.6–1.3	0.7–1.5	1.15–2.9	0.2–0.5	0.85–1.62	1.1–2.7	105 min.
72.5	132	1.3–2.2	1.5–4.1	2.9–4.9	0.5–0.63[a]	1.62–4.13[a]	2.7–4.79	235 min.

[a] Changed gauge.

bgs = below ground surface
cfm = cubic feet per minute
DPE = dual-phase extraction
ft = feet
in. H_2O = inches of water
SVE = soil vapor extraction
VP = vapor point

Notes: Vacuums at all vapor probes gradually increased through the test, with the exception of the VP-4-10 feet, which stabilized after 120 minutes.

Vapor samples collected from DPE-1 at 10, 30, 100, and 235 minutes (shutdown).

TABLE 5-3

Soil Permeability Test Results, DPE-1[a]

Monitoring Well		Flowrate (ft^3/min)	Distance to Extraction Well (ft)	Absolute Pressure Extraction Well (in. H_2O)[b]	Absolute Pressure Monitoring Well (in. H_2O)	Air Permeability (Darcy)	Calculated Radius of Influence (ft)
Well No.	Screen Interval (ft)						
VP-1, 10	9–10	98	25	276.8	403.3	0.70	30.8
VP-1, 20	19–20	98	25	276.8	401.8	0.70	31.6
VP-1, 30	29–30	98	25	276.8	402.3	0.70	30.8
VP-2, 10	9–10	98	50	276.8	405.90	0.77	52.1
VP-2, 20	19–20	98	50	276.8	[c]	[c]	[c]
VP-2, 30	29–30	98	50	276.8	403.60	0.79	59.0

[a] Well casing radius 0.167 feet and well screen in the vadose zone 8 to 43 feet bgs.
[b] Absolute pressure is the difference between vacuum-influenced data and atmospheric pressure (406.8 in. H_2O).
[c] Field data appear high; not used in calculation.

bgs = below ground surface
DPE = dual-phase extraction
ft = feet
ft^3/min = cubic feet per minute
in. H_2O = inches of water
VP = vapor point

TABLE 5-4

Soil Permeability Test Results, DPE-7[a]

Monitoring Well		Flowrate (ft^3/min)	Distance to Extraction Well (ft)	Absolute Pressure Extraction Well (in. H_2O)[b]	Absolute Pressure Monitoring Well (in. H_2O)	Air Permeability (Darcy)	Calculated Radius of Influence (ft)
Well No.	Screen Interval (ft)						
VP-3, 10	9–10	98	50	276.8	404.6	0.80	64.9
VP-3, 20	19–20	98	50	276.8	402.7	0.79	62.0
VP-3, 30	29–30	98	50	276.8	401.9	0.80	64.9
VP-4, 10	9–10	98	50	276.8	406.2	0.77	51.3
VP-4, 20	19–20	98	50	276.8	402.7	0.79	62.0
VP-4, 30	29–30	98	50	276.8	402.0	0.80	64.5

[a] Well casing radius 0.167 feet and well screen in the vadose zone 8 to 43 feet bgs.
[b] Absolute pressure is the difference between vacuum-influenced data and atmospheric pressure (406.8 in. H_2O).

bgs = below ground surface
DPE = dual-phase extraction
ft = feet
ft^3/min = cubic feet per minute
in. H_2O = inches of water
VP = vapor point

TABLE 5-5

Distance and Direction of Vapor Monitor Points Relative to Dual-Phase Extraction Wells

HWA								DPA			
	DPE-1	DPE-2	DPE-3	DPE-4	DPE-5	DPE-6			DPE-7	DPE-8	DPE-9
VP-1[a]	**25 SE**	**73 S**	**108 W**	**41 NW**	**89 NE**	**108 E**		VP-3[a]	**48 NW**	**85 N**	**45 NE**
VP-2[a]	**50 W**	**83 SW**	**126 W**	**111 N**	**59.5 N**	**38 SE**		VP-4[a]	**52 SW**	**3.5 S**	**85 SE**
VP-9	**44 S**				**51 NE**			VP-5	**31 SE**	**49 NE**	
VP-10	**72 SE**			**25 S**				VP-6	**38 NE**		
VP-11			**52 S**	**63 NE**				VP-7		**52 NW**	**48 S**
VP-12			**28 E**	**92 NE**				VP-8			**40 NW**
VP-13		**53 SE**	**59 W**								
VP-14		**25 NE**	**75 E**								
VP-15		**52 W**			**50 NW**						
VP-16						**26 W**					
VP-17					**25 NW**	**55 S**					

[a] Existing vapor monitoring points.

DPE = dual-phase extraction
E = east
N = north
NE = northeast
NW = northwest
S = south
SE = southeast
VP = vapor (monitor) point
W = west

Notes: 1. Distance (in feet) and direction are from DPE to VP (i.e., VP-1 is located 25 feet southeast of DPE-1).
2. N, S, E, W, NE, SE, NW, and SW are general compass direction.

TABLE 5-6

Summary of Monitoring Schedule for DPE with Catalytic Oxidation/Caustic Scrubber Emission Control System and Residual Sampling Frequency

Parameter	Sample Location	Sample Frequency	
		Initial Operations[a]	Long-Term Operations
VOCs (EPA Modified Method TO-15 or approved equivalent)	System Inlet & Outlet	Weekly	Monthly
	Operating DPE Wells	Weekly	Quarterly
	Soil Vapor Monitor Points[b]	Weekly	Quarterly/ SemiAnnually/Annual
	AWS liquids	Once	Annually
	Scrubber Blowdown	Once	Annually
Acid Gas (HCl) (CARB Method 421 or approved equivalent)	System Outlet	Once	Annually
Dioxins/Furans (EPA Method 23 or approved equivalent)	System Outlet	Once	Annually
	AWS liquids	Once	Annually
	Scrubber Blowdown	Once	Annually
$CO/SO_2/NO_x/PM$ (CARB Methods 5 and 10)	System Outlet	Once	Annually

[a] Initial operations typically last one to four weeks. During this time, the remediation equipment is being fine tuned to operate at maximum efficiency given the Site conditions.

[b] Initially all soil vapor monitor points will be sampled quarterly. As concentrations decline, the sampling frequency shall decline as follows:

- Quarterly – soil vapor concentration greater than cleanup goals;
- Semiannual – soil vapor concentrations less than cleanup goals during the previous sample event;
- Annual – soil vapor concentrations less than cleanup goal for two consecutive sample events;
- Stop sampling a well, until confirmation sampling, if soil vapor concentrations less than cleanup goal for three consecutive sample events.
- If concentrations increase above cleanup goals at any time, the well shall resume the quarterly sampling frequency and follow the process listed above.

AWS = air/water separator
CARB = California Air Resources Board
CO = carbon monoxide
DPE = dual-phase extraction
EPA = United States Environmental Protection Agency
HCl = hydrochloric acid
NO_x = nitrogen oxides
PM = particulate matter
SO_2 = sulfur dioxide
VOC = volatile organic compound

FIGURES

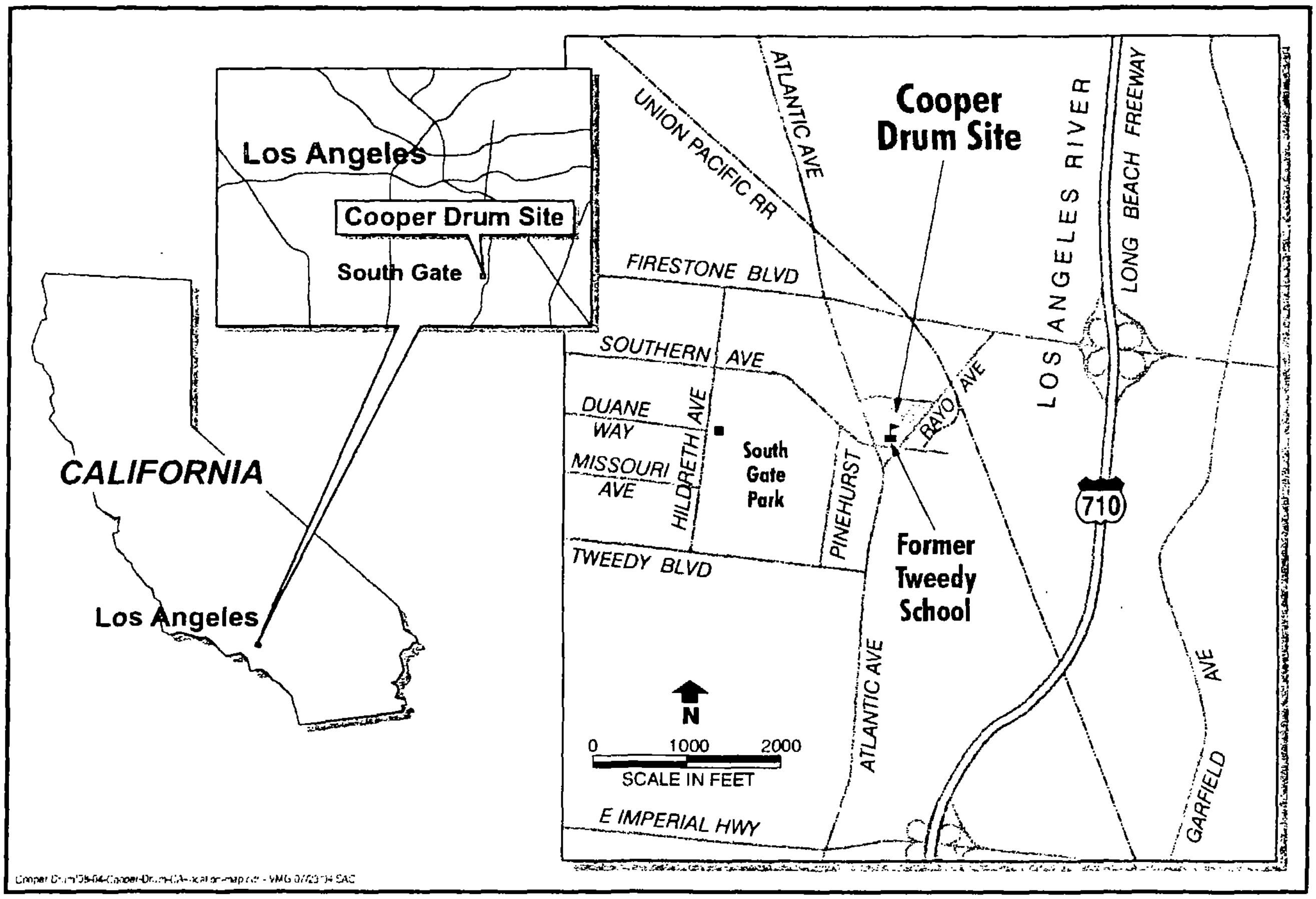
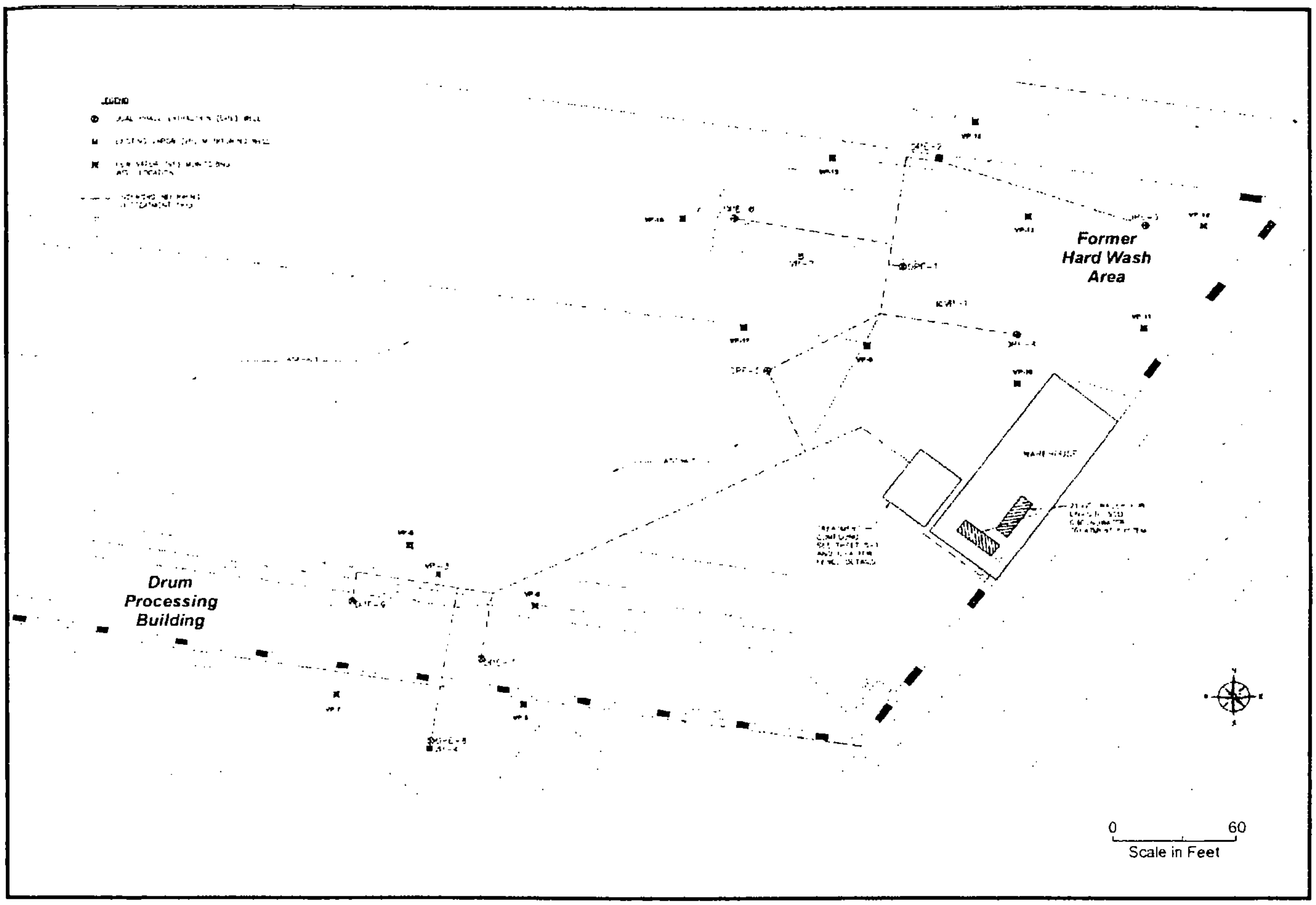


Figure 1-1. Site Location Map

URS



Site Map and Piping Layout

Figure 1-2

Cost Estimate Summary For The Selected Remedy For Soil	
Description	**Cost**
Capital Costs	
Excavation	
Mobilization and Demobilization	$31,961
Excavation and Hauling	$842,785
Confirmation Sampling (Excavation)	$45,500
Dual Phase Extraction	
Permitting	$131,320
Remediation Equipment	$506,889
Treatment Compound Slab	$22,368
Treatment Compound Fence and Bollards	$23,250
Extraction Well Install and Monitoring	$146,630
Treatment Trenching and Piping	$54,914
Wellheads and Equipment Install	$150,777
Initial Startup Test	$8,519
Subtotal (construction)	$1,964,913
Bid contingencies(5% of total)	$98,246
Report preparation (RAWP, HASP, Plans, Final O&M)(5% of total)	$98,246
Field and laboratory testing during construction (1% of total)	$19,649
Reporting during construction (1% of total)	$19,649
Total Capital Cost	**$2,200,703**
OPERATIONS AND MAINTENANCE COSTS	
O&M labor	$40,800
SVE treatment system Sampling	$13,880
O&M material	$9,120
Electrical Utility	$72,883
O&M Analytical	$71,520
O&M Source Testing	$16,510
O&M Reporting	$38,272
Subtotal O&M (Annual Cost)	$262,985
Subtotal O&M (discounted)[a]	**$749,264**
Closure Plans and Sampling [b]	**$86,702**
TOTAL PRESENT VALUE	**$3,036,669**

Date: September 18, 2007

Note: Inflation rates for 2007 through 2009 (As provided in the ROD) was factored into the 7% discount

[a] A 7% discount assumed for 3 years of O&M operation

[b] Closure sampling is assumed to occur in 2010

Cooper Drum
9316 South Atlantic Avenue, South Gate, CA
DUAL PHASE EXTRACTION

Description	Qty	Unit	$/unit	Ext. Cost
Permitting				
Labor:				
PM/Engineer - Senior	40	hr	$ 100.00	$4,000
Engineer - Senior	20	hr	$ 100.00	$2,000
Scientist - Sr	5	hr	$ 100.00	$500
Engineer - Staff	40	hr	$ 75.00	$3,000
Scientist - Staff	40	hr	$ 75 00	$3,000
Procurement	20	hr	$ 60.00	$1,200
Subtotal				$13,700
Permits:				
South Coast AQMD	1	LS	$2,682	$2,682
Utility Costs	24	mo	$3,500	$84,000
Electrical	1	LS	$10,000	$10,000
Natural Gas	1	LS	$5,000	$5,000
Sewer	1	LS	$2,000	$2,000
Bldg. & Planning Dept Permit	1	LS	$2,000	$2,000
Subtotal				$105,682
SUBTOTAL				$119,382
CONTINGENCY (10%)				$11,938
Subtotal				**$131,320**
Remediation Equipment				
Skid Mounted 2 Phase System	1	LS	$274,808	$274,808
See attached estimate				
Hipox Unit and Consumables	1	24 Mo.	$186,000	$186,000
SUBTOTAL				$460,808
CONTINGENCY (10%)				$46,081
Subtotal				**$506,889**
Treatment Compound Slab				
Labor:				
PM/Engineer - Senior	4	hr	$ 110.00	$440
Super/Field Tech - Senior	60	hr	$ 75 00	$4,500
Laborer/Field Tech	60	hr	$ 50.00	$3,000
Laborer/Field Tech	40	hr	$ 50.00	$2,000
Laborer/Field Tech	10	hr	$ 45.00	$450
Laborer/Field Tech	10	hr	$ 45.00	$450
Subtotal				$10,840
Equipment:				
Backhoe	1	week	$ 646.50	$647
Backhoe				$91
Wacker	2	day	$ 48.49	$97
Vibrator	1	day	$ 50.00	$50
Laser	1	each	$ 100.00	$100
Service Truck	2	week	$ 290.00	$580
Service Truck	1	day	$ 73 00	$73
FOGM	6	day	$ 100.00	$600
Misc Tools	1	each	$ 100.00	$100
OVA/PID	1	each	$ 100.00	$100
Subtotal				$2,437
Materials:				
Class II AB	38	ton	$ 24.25	$922
Rebar	1	each	$ 750 00	$750
Concrete	28	cy	$ 112.00	$3,136
Form wood/dobies	1	each	$ 750.00	$750
Visqueen plastic	1	each	$ 150.00	$150
Subtotal				$5,708
Subcontractors:				
A/C and Clean Soil Off-haul	3	load	$ 100 00	$300
A/C and Clean Soil Disposal	3	load	$ 100.00	$300
Temp Fence	1	each	$ 350.00	$350
Utility Locator	1	each	$ 400 00	$400
Subtotal				$1,350
COST SUBTOTAL				$20,334
CONTINGENCY (10%)				$2,033
Subtotal				**$22,368**

Cooper Drum
9316 South Atlantic Avenue, South Gate, CA
DUAL PHASE EXTRACTION

Description	Qty	Unit		$/unit	Ext. Cost
Treatment Compound Fence and Bollard					
Fence	1	LS		$10,000	$10,000
Bollard	1	LS		$13,000	$12,250
COST SUBTOTAL					$22,250
CONTINGENCY (10%)					$1,000
Subtotal					**$23,250**
Extraction well install					
Extraction wells	880	LS		$100	$88,000
Extraction wells labor	150	LS		$90	$12,250
Monitoring wells	416	LS		$50	$20,800
Monitoring wells labor	75	LS		$13,000	$12,250
COST SUBTOTAL					$133,300
CONTINGENCY (10%)					$13,330 0
Subtotal					**$146,630**
Trenching, UG Piping Installation					
Labor:					
PM/Engineer - Senior	20	hr		$110	$2,200
Super/Field Tech - Senior	90	hr		$75	$6,750
Laborer/Field Tech	90	hr		$50	$4,500
Laborer/Field Tech	90	hr		$50	$4,500
Procurement	8	hr		$60	$480
Subtotal					$18,430
Equipment:					
Backhoe	2	weeks	$	646.50	$1,293
					$181
Wacker	2	weeks	$	134 69	$269
Vibratory Plate	2	weeks	$	134.69	$269
Trench Plates	2	weeks	$	88.62	$177
Trench Plate Mob/Demob	4	hour	$	45.00	$180
Equipment Mob/Demob	4	each	$	50 00	$200
Speed Shoring	1	each	$	200 00	$200
Service Truck	16	day	$	75.00	$1,200
FOGM	16	day	$	100.00	$1,600
Subtotal					$5,570
Materials:					
Primer & Glue	6	each	$	65 00	$390
Sand Bedding	90	ton	$	22 00	$1,980
Class II AB	30	ton	$	24 25	$728
Magnetic Warning Tape	1000	lf	$	0 50	$500
2-in sch 80 PVC (GW)	1000	lf	$	4 08	$4,080
4-in sch 80 PVC (SVE)	500	lf	$	9.11	$4,555
6-in sch 80 PVC (SVE)	500	lf	$	17 39	$8,695
1-in Electrical conduit	1000	lf	$	1 32	$1,320
Sales Tax					$1,724
Subtotal					$23,972
Subcontractors:					
Temp Fence	1	each	$	350 00	$350
Clean Soil Off-haul	8	load	$	100 00	$800
Clean Soil Disposal	8	load	$	100.00	$800
Subtotal					$1,950
COST SUBTOTAL					$49,922
CONTINGENCY (10%)					$4,992
Subtotal					**$54,914**

Cooper Drum
9316 South Atlantic Avenue, South Gate, CA
DUAL PHASE EXTRACTION

Description	Qty	Unit		$/unit	Ext. Cost
Wellheads and Equipment Placement at Pad					
Labor					
PM/Engineer - Senior	5	hr		$110	$550
Super/Field Tech - Senior	80	hr		$75	$6,000
Laborer/Field Tech	80	hr		$50	$4,000
Laborer/Field Tech	80	hr		$50	$4,000
Subtotal					$14,550
Equipment:					
Fork Lift	2	days	$	312.48	$625
Service Truck	2	weeks	$	290.00	$580
FOGM	10	day	$	100.00	$1,000
Subtotal					$2,205
Materials:					
Miscellaneous	1	LS	$	1,000.00	$1,000
Grundfos pumps	9	each		$1,035	$9,315
Well Vault	9	each		$2,500	$22,500
Well Vault Components (piping, controls, gauges)	9	each		$2,500	$22,500
Monitoring Well Vault	13	each		$2,500	$32,500
Monitoring Well Vault (piping, controls, gauges)	13	each		$2,500	$32,500
Subtotal					$137,070
CONTINGENCY (10%)					$13,707
Subtotal					**$150,777**
STARTUP - 3 day Shakedown					
Labor:					
PM/Engineer - Senior	15	hr		$110	$1,650
Super/Field Tech - Senior	30	hr		$75	$2,250
Super/Field Tech - Senior	30	hr		$76	$2,280
Subtotal					$6,180
Equipment:					
Service Truck	3	day	$	75.00	$225
FOGM	3	day	$	100.00	$300
Subtotal					$525
Utilities:					
Electricity	2,400	kwh		$0.14	$336
Natural Gas	300	therm		$0.72	$216
Sewer	86	Kgal		$5.64	$487
Subtotal					$1,039
SUBTOTAL					$7,744
CONTINGENCY (10%)					$774
Subtotal					**$8,519**
TOTAL					**$1,044,666**

Remediation Equipment Costs

Company	Description of Equipment	Cost ($)	Comments
Applied	Hipox Rental 2 years	108,000.00	
Applied	Freight in and out	5,000.00	
Applied	isntallation/start up	6,000.00	
Applied	demobe	1,000.00	
Applied	preventative maintenance	12,000.00	
Applied	electricity (8,000 kw/month)	19,200.00	
Applied	peroxide (35%) 2.3 gal/day	8,400.00	
Applied	liquid oxygen	26,400.00	
	Subtotal	**186,000.00**	
Baker Furnace	Thermal Oxidizer/Scrubber	250,000.00	
	Tax (7.75%)	19,375.00	
	Freight	1,000.00	
	Subtotal for Oxidizer Only	**270,375.00**	
Soil Therm	Oxidizer/Scrubber	168,900.00	
Soil Therm	Heat Exchanger	18,000.00	
	Tax (7.75%)	1,395.00	
	Freight	1,000.00	
	Subtotal for Oxidizer Only	**189,295.00**	
Baker Furnace	Scrubber sump	21,145.00	
Baker Furnace	9 grundfos pumps	9,315.00	
Baker Furnace	2 1,000 lb GAC vessels	9,600.00	
Baker Furnace	500 Gallon Poly Tank	750.00	
	Tax (7.75%)	3,162.78	
	Freight	1,000.00	
	Subtotal for Addtional Components	**44,972.78**	
	Total for System (no Hipox)	**274,807.78**	

Average price for Oxidizer and Baker Components

Cooper Drum
9316 South Atlantic Avenue, South Gate, CA
EXCAVATION

Description	Qty	Unit	$/unit	Ext. Cost
MOBILIZATION/DEMOBILIZATION				
HASP Preparation				
Labor:				
PM/Sr.Geologist - Senior	40	hr	$ 100.00	$4,000
Geo/Engineer - Senior	20	hr	$ 100.00	$2,000
CIH	20	hr	$ 100.00	$2,000
Engineer - Staff	40	hr	$ 75.00	$3,000
Scientist - Staff	40	hr	$ 75.00	$3,000
Subtotal				$14,000
Permitting				
Labor:				
PM/Engineer - Senior	5	hr	$ 100.00	$500
Engineer - Staff	10	hr	$ 75.00	$750
Scientist - Staff	10	hr	$ 75.00	$750
Permits:				
Bldg. & Planning Dept Permit	1	LS	$ 2,000.00	$2,000
Subtotal				$4,000
Site Setup and Close				
Labor:				
PM/Engineer - Senior	10	hr	$ 100.00	$1,000
Engineer - Staff	20	hr	$ 75.00	$1,500
Laborer/Field Tech	80	hr	$ 60.00	$4,800
Procurement	8	hr	$ 60.00	$480
Equipment:				
Service Truck	5	day	$ 75.00	$375
FOGM	5	day	$ 100.00	$500
ODCs:				
Airline Ticket (Roundtrip)	3	ea	$ 300.00	$900
Hotel Room	10	night	$ 150.00	$1,500
Subtotal				$11,055
SUBTOTAL				$29,055
CONTINGENCY (10%)				$2,906
Subtotal				**$31,961**
EXCAVATION				
Labor:				
PM - Senior	15	hr	$ 110.00	$1,650
Super/Field Tech - Senior	160	hr	$ 75.00	$12,000
Super/Field Tech - Senior	40	hr	$ 112.50	$4,500
Laborer/Field Tech	160	hr	$ 50.00	$8,000
Laborer/Field Tech	40	hr	$ 75.00	$3,000
Laborer/Field Tech	160	hr	$ 50.00	$8,000
Laborer/Field Tech	40	hr	$ 75.00	$3,000
Chemist	39	hr	$ 90.00	$3,510
Subtotal				$43,660
ODCs:				
Airline Ticket (Roundtrip)	45	ea	$ 300.00	$13,500
Hotel Room	60	night	$ 150.00	$9,000
Car Rental	15	wk	$ 250.00	$3,750
Field Trailer	1.25	mo	$ 350.00	$438
Subtotal				$26,688

Cooper Drum
9316 South Atlantic Avenue, South Gate, CA
EXCAVATION

Description	Qty	Unit	$/unit	Ext. Cost
Analytical:				
Field Test Kit - PCB	65	ea	$ 30.00	$1,950
Field Test Kit - PAH	65	ea	$ 100.00	$6,500
Field Test Kit - Lead	65	ea	$ 100.00	$6,500
Field Test - Lead XRF	1	mo	$ 750.00	$750
Lead (6010 B)	13	ea	$ 150.00	$1,950
PCBs (8082)	13	ea	$ 420.00	$5,460
PAHs (8310)	13	ea	$ 195.00	$2,535
Waste Characterization Sampling	9	ea	$ 150.00	$1,350
Subtotal				$26,995
Unit Costs for Excavation Activities:				
Removal of Excavated Soil	1,271	cy	$ 20.00	$25,420
Removal of Excavated Soil - Contingency (30%)	381	cy	$ 20.00	$7,626
Demolish Asphalt in Excavated Areas	175	cy	$ 70.00	$12,250
Loading and Hauling of Asphalt Material	228	tons	$ 60.00	$13,650
Asphalt Patching of Excavated Area	9,575	sf	$ 5.00	$47,875
Disposal of Asphalt	228	tons	$ 15.00	$3,413
Transportation of Contaminated Soil to Class I Landfill	1,652	tons	$ 215.00	$355,245
Shoring	460	lf	$ 15.00	$6,900
Utility Clearance	1	LS	$ 1,000.00	$1,000
Import Clean Fill and Backfill	1,271	cy	$ 56.00	$71,176
Compaction Testing	16	ea	$ 400.00	$6,400
Subtotal				$550,954
COST SUBTOTAL				$648,297
CONTINGENCY (30%)				$194,489
Subtotal				**$842,785**

Assumptions

Excavation:

Estimated excavated volume of contaminated soil: 1270 yd^3 (Assumes no additional soil to be excavated).
- DPA West - 395 yd^3
- DPA East - 370 yd^3
- HWA West - 110 yd^3
- HWA East - 280 yd^3
- Soil Expansion (10%) - 116 yd^3

Project Duration - 5 weeks (20, 10-hr work days)

Transportation of Material

Asphalt material:

Asphalt to be disposed at local landfill (assumed one way distance = 50 miles).

Contaminated Soil:

Assume 1,270 yd^3 (approximately 1650 tons) to be transported to Class I landfill (Buttonwillow, CA).
Costs include loading, hauling, and disposal fees.
Mass of Soil = 1.3 tons/yd^3

Project Staffing:

Onsite Personnel: 3 full time personnel (48 hours/week, including travel).
Project Chemist: Assume 0.2 hours/sample for project setup, lab coordination, QA/QC of data.
Project Management Oversight: 3 hour/week.

Contractor Travel:

3 personnel onsite for full duration of project.
Per Diem of $130/day = 60 days total.
Weekly Travel from SMF to LAX (3 trips per person = 12 total).
Car rental during duration of project.

Other:

Access to site utilities for field trailer and bathroom.

Cooper Drum
9316 South Atlantic Avenue, South Gate, CA
EXCAVATION - CONFIRMATION SAMPLING

Initial Sampling:				Initial Sampling Effort				2nd Round Sampling Effort			
Site Location	Excavation Wall Lengths (ft)		Excavation Perimeter Area (ft^2)	PAH	Lead	PCB	Initial Confirmation Sampling Totals	PAH	Lead	PCB	Second Round Confirmation Sampling Totals
DPA West	65	60	3900	16	16	16	48	8	8	8	24
DPA East	80	25	2000	11	11	11	33	1	1	1	3
HWA West	30	40	1200	8	8	8	24	1	1	1	3
HWA East	60	50	3000	13	13	13	39	7	7	7	21
Totals				48	48	48	144	17	17	17	51

	PAH	Lead	PCB	
Totals:	65	65	65	
Sample Costs	$195.00	$420.00	$85.00	
Ext. Costs	$12,675	$27,300	$5,525	
Total Cost:				$45,500

Confirmation Samples collected every 40 ft on the sidewalls, below the zone of contamination and on 20 ft centers on the excavation floor

Assume 50% of samples will be "hot" in uncharacterized areas (DPA West and HWA East) and resampling will be required.
Assume 10% of samples will be "hot" in characterized areas (DPA East and HWA West) and resampling will be required.

O&M - 3 years

Assumptions:

O&M period will be for 3 years

O&M Contractor will provide materials, equipment and labor to operate and maintain soils remedy.

Costs do not include treatment system installation.

Project staff will conduct preventative maintenance and repairs for the systems and related equipment. This includes all vapor pipelines and utility pipelines that are not utility-owned and maintained. Utility marking for USA dig clearances will also be included in the project.

The project engineer will troubleshoot problems with the system operators, perform RPO analysis, and analyze operations data.

General Support - URS will provide a technician to assist system operators with procurement, supply errands spare parts inventory, vehicle maintenance, and field financial tracking.

The project manager will be responsible for providing direction to field staff, resolving technical problems, communicating with the client and engineering staff. 1 hour weekly meetings will be conducted with field staff. Weekly URS internal management meetings will also be conducted with the project management team

Engineering support will assist operators with process problems, optimization, and resolution of technical issues.

Maintain property inventory, prepare yearly property report, conduct inventory audits.

O&M General Support

Role	Rate	Hrs/month	# of Months	Total
Technician	$50.00	8	36	$1,800
Field Engineer	$75 00	8	36	$2,700
Project Manager	$100.00	20	36	$3,600
Procurement	$60.00	6	36	$2,160
Property Administration	$60.00	0.5	36	$2,160
Subtotal		42.5		$12,420

Health and Safety - O&M Contractor will conduct 4 quarterly audits with written findings and recommended corrective actions. H&S staff will also be asked to review and assist with routine and non-routine operations throughout the year.

Health & Safety

Role	Rate	Hrs/event	# of Events	Total
H&S Officer - 4 events/year	$100.00	16	12	$1,200
H&S Officer - 12 events/year	$100.00	8	36	$3,600
H&S Technician	$60.00	8	36	$2,160
Subtotal		16		$6,960

QA Audits - O&M Contractor will conduct quarterly QA audits on standard operating procedures.

Findings and corrective actions will be documented in the quarterly report.

QA Audits

Role	Rate	Hrs	# of Events	Total
QA Manager - 4 events	$100.00	6	4	$2,400
Field Engineer	$75.00	6	6	$2,700
Chemist	$90.00	12	4	$4,320
Subtotal		24		$9,420

DPE System

10 hours per week for routine operations and maintenance - includes 1 using SCADA to collect readings and inspect operation of system. Routine maintenance includes - oil changes, cleaning of the site, performance of semiannual system interlock checks, quarterly blower and pump vibration testing, calibration/replacement of pH probes, cleanout and acid washing of scrubber, replacement/repair of malfunctioning instrumentation, inspection/replacement of blower belt, and draining of low point drains.

2 hours per week of nonroutine repairs, restarts, troubleshooting

Role	Rate	Hrs	# of Weeks	Total
Field Technician	$50.00	12	156	$93,600
Subtotal 3 year				$122,400
Total Annual				$40,800

Task 4 RAO Non-Labor Items

Materials/Supplies	Rate Frequency	Quantity	Cost/Item	Total	Justification
Supplies / Expenses					
Cellular Phone(1000 minute plans)	Each	12	$56.91	$682.92	12 months
System Phone Lines	Phone/Month	12	$44.71	$536.52	Jan 07 - AT&T
Fed Ex (50lb) Standard Overnight	Each	24	$43.45	$1,042.80	2 per month
1 Liter Amber Glass (QC Class)	Case (12)	1	$32.00	$32.00	.5 per month
8 oz glass jars	Case(12)	1	$19.20	$19.20	.5 per month
1 Liter Wide Mouth (poly)	Case (24)	1	$49.09	$49.09	.5 per month
40ml Voa Vials w/0.5hcl (amber, QC Class)	Case (72)	1	$116 90	$116.90	.5 per month
Acid - Muriatic	Gallon	1	$12.00	$12.00	2 per month
Additional Field Supplies	Each	1	$500.00	$500.00	2 per year
Air Filters (Catox)	Each	3	$120.29	$360.87	1 every 2 months
Blower Belts	Each	3	$114.00	$342.00	2 per year
Caustic Pump repair kit	Each	4	$83.00	$332.00	4 per year
Exhaust Fan	Each	1	$82.00	$82.00	1 per year
Fire Extinguisher	Each	4	$30.00	$120.00	2 per quarter
Flow Meter (soil vapor)	Each	1	$166.00	$166.00	2 per year
Flow sensors	Each	1	$145.00	$145.00	1 per system per year
Fuses	Each	2	$12.50	$25.00	2 per year
Hose	Each	1	$31.55	$31.55	1 per system
Hour Meter	Each	6	$60.00	$360.00	1 per year
Level Switches	Each	12	$67.00	$804.00	3 per quarter
Light bulbs	Each	24	$1.50	$36.00	2 per month
Oil	Each	4	$10.00	$40.00	1 quart per system per quarter
pH Buffers - pH10	Gallon	4	$33.85	$135.40	1 per quarter
pH Buffers - pH4	Gallon	4	$33.85	$135.40	1 per quarter
pH Buffers - pH7	Gallon	4	$33.85	$135.40	1 per quarter
pH Probes (FTO)	Each	1	$205.00	$205.00	4 per oxidizer
PID	Each	0	$3,749.70	$0.00	1 per year
Pressure Gauges	Each	6	$26.93	$161.58	6 per year
Pressure Switches	Each	4	$225.00	$900.00	4 per year
PVC check valves	Each	2	$45.00	$90.00	1 per month
PVC fittings	LS	1	$2,400.00	$2,400.00	1 per year
PVC Glue/Primer/Sealant	LS	1	$2,200.00	$500.00	1 per year
PVC pipe	LS	1	$2,400.00	$2,400.00	1 per year
PVC Valve Replacement	Each	2	$80.00	$160.00	2 per system per year
Rotameter	Each	4	$65.95	$263.80	1 per quarter
Sealant	Each	3	$12.00	$36.00	2 per month
Silicone Tubing	Foot	12	$50.77	$609.24	1 per month
Silicone	Each	12	$4.25	$51.00	6 per month
Site Signs	Each	2	$75.00	$150.00	2 per system
Sodium Hydroxide	Gallon	1200	$1.30	$1,560.00	100 gallons per month
Solenoid Valve - 1/2"	Each	2	$123.00	$246.00	2 per year
Solenoid Valve - 1"	Each	2	$195.00	$390.00	3 per year
Spill Kits	Each	1	$200.00	$200.00	4 per year
Teflon Tape 1/2"	Roll	48	$2.00	$96.00	4 per month
Temperature Gauges	Each	2	$35 00	$70.00	4 per system per year
Temperature Switches	Each	2	$132 60	$265.20	2 per year
Thermocouples	Each	3	$96.00	$288.00	6 per year
Valve Replacement	Each	4	$150.00	$600.00	1 per quarter
Vapor Hose	Each	50	$5.50	$275.00	50 per year
Vacuum Gauges	Each	1	$34.00	$34.00	1 per system per year
Zip lock Bags (12"x15")	Box of 500	2	$189.00	$378.00	2 per year

Task 4 RAO Non-Labor Items

Materials/Supplies	Rate Frequency	Quantity	Cost/Item	Total	Justification
			TOTAL	**$18,570.87**	
SUBCONTRACTORS					
Fire Extinguisher Inspection	Each	1	$9.00	$9.00	1 per year
Hazardous Waste Disposal - Solids	Each	2	$250.00	$500.00	1 drum per quarter
Hazardous Waste Disposal - Oil	Each	2	$130.00	$260.00	1 per quarter
TRAVEL					
Van/Truck Gasoline	Gallon	900	$3.00	$2,700.00	75 gallons per truck per month
Van/Truck Rental	Month	12	$534.97	$6,419.64	1 trucks per month
			TOTAL	**$9,119.64**	
			TOTAL	**$9,119.64**	per year
Electrical utility					
Based on 22kw 24/7 -365 year	kWh	560640	$0.13	**$72,883.20**	1 per year
			Years of O&M	**3**	years
			GRAND TOTAL	**$246,008.52**	

Sampling & Analysis - 3 years O&M, 1 year rebound sampling, 1 closure sampling

Analytical Assumptions:

The analytical laboratory costs are based on quotes obtained in January 2006.

18 monthly SVE well samples, 2 system samples monthly

36 quarterly SVM well samples

Basis of Estimate

Method	Samples	Unit Cost	Total Cost	Laboratory
TO-15S (Short List)	576	$110	$63,360	Air Toxics
TO-15/TVH (Full Scan)	720	$210	$151,200	Air Toxics
ASTM D1946 (fixed Gas Analysis)		$55	$0	Air Toxics
SW 8260 Halocarbons Water Analysis		$105	$0	EMAX
EPA 1613 (D/F water analysis)		$825	$0	EMAX
EPA 6010 TAL Metals		$160	$0	EMAX
SW 7196 Hex. Chromium Water Analysis		$60	$0	EMAX
Method 160.1 / 160.2 (TDS / SS Water)		$20	$0	EMAX
Method 300.0 (Chloride) Analysis		$20	$0	EMAX
Method 7470 (Hg) water analysis		$28	$0	EMAX
LC 50 Bioassay water analysis			$0	
WET/TCLP VOCs (8260) Residuals		$175	$0	EMAX
WET/TCLP Metals		$125	$0	EMAX
TOTAL 3 Years	1,296		$214,560	
TOTAL O&M Analytical Annual			$71,520	

Closure Plans and Sampling

Direct Push collection at 10 locations with soil gas samples at 4 discrete depths per location

Assumptions:

Assumes O&M sampling for 3 years, duration of O&M, then shut down the system and collect quarterly sampling for 1 year to evaluate any concentration rebound in existing wells, then perform closure sampling. Closure sampling will be conducted by collecting soil gas samples away form existing wells to evaluate site closure. Collect system samples and online wells monthly, and well monitoring samples quarterly.

Basis of Estimate:

Role	Rate	Hrs	# of Months	Cost
Field Sampler to perform soil gas sampling	$50.00	2	36	$3,600.00
Field Sampler to document field sampling activities, COC completion, shipping, labeling	$50.00	1	36	$1,800.00
Project Chemist to review/validate analytical data	$90.00	1	36	$3,240.00
Data Manager to collect/organize lab data, and enter data	$75.00	1	36	$2,700.00
Subtotal				$11,340

Sampling Plan

Role	Rate	Hours	
Engineering to prepare quarterly sample plan	$75.00	4	$300.00
Project Manager to review quarterly sample plan	$100.00	4	$400.00
Independent Technical Review of plan	$100.00	4	$400.00
Project Chemist to prepare sample plan	$90.00	16	$1,440.00
Subtotal			$2,540
Total Annual Sampling Cost			**$13,880**

Create a Post Remedial Soil Confirmation and Groundwater Monitoring Plan

Basis of Estimate :

Labor

Role	Category	Draft	Final	Total Hours	Unit Cost	Total Cost
Project Mgr	Geologist - Sr	24	16	40	$ 90.00	$ 3,600.00
Author/Review Engineer - Sr	Engineer - Sr	24	16	40	$ 107.00	$ 4,280.00
Author - Engineer	Engineer - Jr	80	24	104	$ 68.00	$ 7,072.00
Author - Geologist	Geologist - Jr	80	24	104	$ 60.00	$ 6,240.00
Author - Geo Sr	Geologist - Sr	24	4	28	$ 90.00	$ 2,520.00
Geo SR - field oversight	Geologist - Sr	16	4	20	$ 90.00	$ 1,800.00
CADD/Graphics	CADD - Mid	40	8	48	$ 80.00	$ 3,840.00
Chemistry	Chemist - Mid	24	4	28	$ 63.00	$ 1,764.00
Word Processor	Clerical - Mid	16	8	24	$ 50.00	$ 1,200.00
Tech Editing	Clerical - Mid	16	8	24	$ 50.00	$ 1,200.00
Document Reproduction	Clerical - Jr	8	8	16	$ 40.00	$ 640.00
Data Management	Scientist - Mid	4	4	8	$ 73.00	$ 584.00
Total Labor		356	128	484		$ 34,740.00

ODCs

Item	Units	Quantity	Unit cost	Total	Basis
Sample shipping	each	1	$ 200 00	$ 200.00	
Copies	pages	75			Internal draft x 3 copies x 25 pages
	pages	75			Client draft x 3 copies x 25 pages
	pages	75			Internal final x 3 copies x 25 pages
	pages	100			Client final x 4 copies x 25 pages
Total B&W Copies		260	$ 0.07	$ 18.20	
Total Color Copies		65	$ 0 60	$ 39.00	
Total ODCs				**$ 257.20**	

Direct Push Field Effort Subcontractors

Description	Unit	Qty	Cost per Unit	Total Cost
Direct Push	ft	1,600	$12.50	$20,000
Grout	ft	1,600	$2.00	$3,200
Soil Gas Sample	ea	40	$145.00	$5,800
Mob/Demob	hr	3	$185.00	$555
Per Diem (per 2 man crew)	day	8	$170.00	$1,360
TOTAL				$30,915

Remediation Completion Report

Document the closure sampling effort in a Remediation Completion Report (RCR) and receive CVRWQCB approval. The RCR shall summarize:

Implementation of the FRP;

Post-Remedial Soil Confirmation and Groundwater Monitoring activities; and

Closure sampling results and conclusions

Basis of Estimate :

Labor

Role	Category	Draft	Final	Total Hours	Unit Cost	Total Cost
Project Manager	Geologist - Sr	40	40	80	$ 90.00	$ 7,200 00
Author	Engineer - Jr	80	40	120	$ 68 00	$ 8,160.00
Graphics	CADD - Mid	40	20	60	$ 80 00	$ 4,800 00
Technical Editing	Clerical - Mid	8	8	16	$ 50.00	$ 800 00
QA Manager	Engineer - Sr	8	8	16	$ 107.00	$ 1,712.00
Word Processing	Clerical - Mid	8	4	12	$ 50 00	$ 600.00
Document Reproduction	Clerical - Jr	2	2	4	$ 40.00	$ 160.00
Data Management	Scientist - Mid		4	4	$ 73 00	$ 292.00
Total Labor		**346**	**210**	**556**		**$ 43,104.00**

ODCs

Item	Units	Quantity	Unit cost	Total	Basis	
Copies	pages	75			Internal draft x 3 copies x 25 pages	
	pages	75			Client draft x 3 copies x 25 pages	
	pages	75			Internal final x 3 copies x 25 pages	
	pages	100			Client final x 4 copies x 25 pages	
Total B&W Copies		260	$ 0.07	$18 20		
Total Color Copies		65	$ 0 60	$39 00		
Total ODCs				**$57.20**		

Total for Closure Sampling 3 year	**$109,073**
Discounted total for Closure Sampling 3 year	**$86,702**

Source Testing - Annual for 3 years

Assumptions:

The oxidizer system will be sampled annually.

Parameters to be sampled during annual testing will include:
- Dioxins/furans, HCl-HF, particulate matter, and CEM (NOx, SO2, and CO) testing.

QC samples will be collected on a frequency of ~10% of total sample number (rounding down).
At least one QC sample (i.e., field blank sampling train) will be collected for each parameter over the sampling year.
Dioxin/furan samples will be collected according to EPA Method 23 procedures.
HCl-HF samples will be collected according to CARB Method 421 procedures.
Particulate matter will be collected according to CARB Method 5 procedures.
CO, NOx, and SO2 will be collected according to CARB Method 100 procedures. Three 40-minute runs will be performed.
Ambient HCl-HF screening level measurements will be determined using indicator tubes.
HCl-HF samples will be collected at inlet and outlet locations. Three 1-hour samples will be collected at the location.
Costs for a test plan or interactions with regulatory agencies have not been included.
Electrical power will be provided at test site.
A unique report will be prepared.
Field team of three people will be able to conduct the testing.
A lift will be needed to access the exhaust stack of the SVE system for a total of 3 days.

Basis of Estimate

Source Testing

Assumes 1 oxidizer system will be tested
Each system will be sampled for dioxins/furans, HCl/HF, PM, NOx, SO2, and CO (separate from the Sampling task analytical).
One report will be prepared.

Field Work

	Category	Hours	# of Units	Total Hours	Cost
Source Tester 1 - Mob/Demob	Sr Enviro Engr	4	1	4	$400
Source Tester 2 - Mob/Demob	Engr Tech - Jr	4	1	4	$300
Sampling - Source Tester 1	Sr Enviro Engr	20	1	20	$2,000
Sampling - Source Tester 2	Engr Tech - Jr	20	1	20	$1,500
CEM Support - Mob/Demob	Jr Enviro Engr	4	1	4	$300
CEM Sampling	Jr Enviro Engr	16	1	16	$1,200
Subtotal				68	$5,700

Reporting

	Category	Hours	# of Units	Total Hours	Cost
Primary Author	Sr Enviro Engr	8	2	16	$1,600
Primary Author	Engr Tech - Jr	4	4	16	$1,200
Primary Author - CEM	Jr Enviro Engr	2	6	12	$1,200
Peer Review	Sr Enviro Engr	2	2	4	$400
Word Processing	Clerical - Sr	2	4	8	$400
Subtotal				56	$4,800

Materials/Supplies	Category	Rate Frequency	Quantity	Cost/Item	Total
OFFICE COSTS					
Fed Ex (50lb) Standard Overnight	Freight	Each	1	$ 43.45	$ 43.45
				Subtotal	$ 43.45

Supplies					
1 Liter Amber Glass (QC Class)	Supplies	Case (12)	1	$ 32.00	$ 32.00
1 Liter Polyethylene Bottles	Supplies	Case (12)	1	$ 30.00	$ 30.00
Gloves - latex disposable	Supplies	Box of 100	1	$ 9.50	$ 9.50
Ice - 7lb Bag	Supplies	Bag	10	$ 1.50	$ 15.00
Paper Towels	Supplies	Roll	1	$ 1.45	$ 1.45
Tape (2" clear packing)	Supplies	Roll	1	$ 5.42	$ 5.42
Tape (duct)	Supplies	Each	1	$ 3.13	$ 3.13
Teflon Tape 1	Supplies	Roll	1	$ 12.00	$ 12.00
Trash Bag - 33gal	Supplies	Box of 100	0	$ 28.40	$ -
Water (Distilled) HPLC	Supplies	Each	1	$ 40.06	$ 40.06
Sampling Filters	Supplies	Box of 25	1	$ 80.00	$ 80.00
Silica Gel	Supplies	Each	0.5	$ 60.00	$ 30.00
Sodium Bicarbonate	Supplies	Each	0.5	$ 45.00	$ 22.50
Sodium Carbonate	Supplies	Each	0.5	$ 40.00	$ 20.00
Acetone	Supplies	Gallon	1	$ 45.00	$ 45.00
Methylene Chloride	Supplies	Gallon	1	$ 45.00	$ 45.00
Toluene	Supplies	Gallon	0.5	$ 45.00	$ 22.50
HCl Indicator Tubes	Supplies	Box	0.5	$ 60.00	$ 30.00
HF Indicator Tubes	Supplies	Box	0.5	$ 60.00	$ 30.00
Orsat Chemicals	Supplies	Each	1	$ 45.00	$ 45.00
Zip lock Bags (12"x15")	Supplies	Box of 500	0.25	$ 189.00	$ 47.25
				Subtotal	$ 565.81
RENTALS					
CEM Truck (with SO2 CEM)	Rental	Day	0	$ 500.00	$ -
Calibration Gases	Rental	Day	2	$ 125.00	$ 250.00
Scissors lift	Rental	Day	2	$ 200.00	$ 400.00
				Subtotal	$ 650.00
REPRODUCTION					
Blue Lines	Repro	Each		$ 2.00	$ -
Color Copies 8.5 x 11	Repro	Each	0	$ 1.35	$ -
Color Copies 11 x 17	Repro	Each		$ 2.70	$ -
Grey Scale Copies	Repro	Copy		$ 20.00	$ -
Mylar Sheets	Repro	Sheet		$ 3.12	$ -
Overhead Frames	Repro	Each		$ 0.50	$ -
Plate Holders	Repro	Each		$ 0.14	$ -
Plate Reproduction	Repro	Plate		$ 2.20	$ -
Reproduction	Repro	Each	0	$ 0.06	$ -
Transparencies	Repro	Each		$ 1.00	$ -
Tabs	Repro	Each	0	$ 0.25	$ -
				Subtotal	$ -
TRAVEL					
M&IE	Travel	Day	0	$ -	$ -
Per Diem	Travel	Day	3	$ 159.00	$ 477.00
Lodging	Travel	Day	0	$ -	$ -
Local Mileage	Travel	Miles	672	$ 0.445	$ 299.04
Van/Truck Gasoline	Travel	Gallon	0	$ 2.50	$ -
Van/Truck Rental	Travel	Month	0	$ 1,200.00	$ -
				Subtotal	$ 776.04
				Subtotal	$ 2,035.30

Analytical - Source Testing

Compound	$/sample	# samples	QC	Total $	
PCDD/PCDF	$ 975.00	1	1	$ 1,950.00	STL - Sacramento
XAD trap prep	$ 100.00	2	2	$ 400.00	STL - Sacramento
HCl/HF	$ 75.00	6	4	$ 750.00	STL - Sacramento
Particulate matter	$ 175.00	3	2	$ 875.00	
Subtotal				$ 3,975.00	

Total	**$ 16,510.30**

OHM Reports

Quarterly SVE Vadose Zone Monitoring Report

Assumptions:

Reported quarterly (final due no later than 60 days from the end of the quarter)

Reports will be 2Q2006 through 1Q2007.

Any comments from the regulatory agencies will be addressed in the pursuant report in a response to comments table.

Basis of Estimate :

Role	Category	Total Hours Per Report	# of Reports	Total Hours	Cost
Project / Jr Engineer/Geologist to update system and site spreadsheets, update site-specific	Enviro Engr - Jr	48	4	192	$14,400.00
Senior to update and review soil and groundwater isoconcentration maps + evaluate	Geologist - Sr	8	4	32	$3,200.00
Technical Editor to conduct a technical review of each site	Tech Writer - Mid	12	4	48	$2,400.00
Author to address any comments/issues brought up from peer review	Enviro Engr - Jr	8	4	32	$2,400.00
Word Processor to make updates from technical Editor and Peer Review	Clerical - Sr	18	4	72	$5,400.00
Project Chemist to prepare Data Quality Assessment (DQA)	Chemist - Mid	8	4	32	$2,880.00
External Independent Technical Review of Entire Report	Enviro Engr - Sr	16	4	64	$6,400.00
TOTAL		102		472	$37,080.00

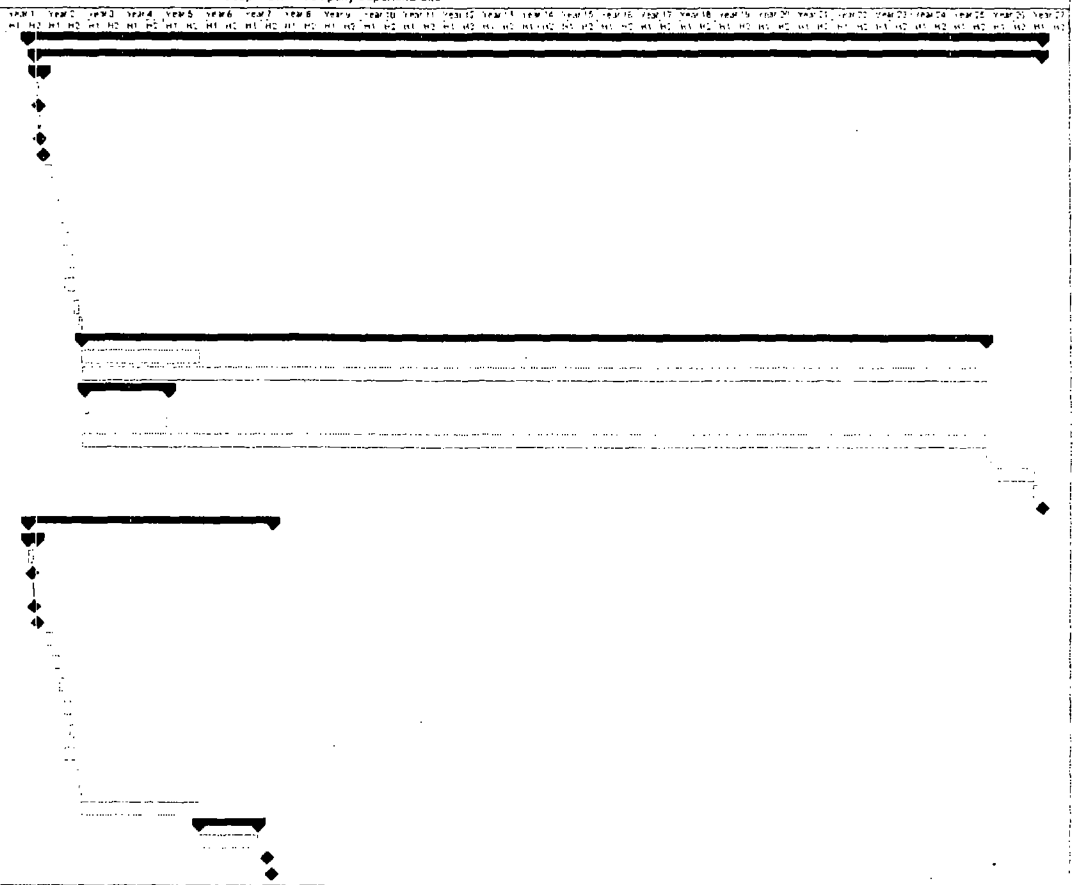
ODC's

Item	Units	Quantity	Unit cost	Total	
Copies - B&W	pages	8,000	$ 0.07	$560.00	Quarterly Report, 200 pages, 10 copies
Color Copies	pages	150	$ 0.75	$112.50	figures, well status table, covers
3", D-Ring Binders	ea	15	$ 3.94	$59.10	Express
5-cut tabs	ea	300	$ 0.49	$147.00	tabs/report
Fed Ex (Up to 5 lbs)	ea	24	$ 5.98	$143.52	
Compact Discs, box of 10	ea	6	$ 28.30	$169.80	
		TOTAL		$1,191.92	

O&M Reports Total	$38,271.92

OU 1 and OU 2
Remedial Action Schedule
Cooper Drum Company Superfund Site

ID	Task Name	Duration	Predecessors
1	**Cooper Drum Remedial Action**	**6723 days**	
2	**OU 1 (Groundwater) RA**	**6674 days**	
3	**RA Solicitation**	**84 days**	
4	Post solicitation	30 edays	
5	Receive proposals	0 days	4
6	Review solicitation proposals	10 days	5
7	Award subcontract	0 days	6
8	Notice-to-Proceed	0 days	7FS+30 edays
9	Preparation of Draft Plans (RAWP, SAP, HASP)	60 days	8
10	Regulatory Agencies Review of Draft Plans	60 edays	9
11	Incorporate Comments and Submit Draft Final Plans	30 days	10
12	Regulatory Agencies Review of Draft Final Plans	60 edays	11
13	Incorporate Comments and Submit Final Plans	30 days	12
14	Permitting for RA (WDR, NPDES, Building Dept, etc)	90 edays	13FF
15	Installation of Remedy	90 days	14
16	Initial Startup and Testing	15 days	15
17	**Full Scale O&M of RA Remedy**	**[illegible] days**	
18	Source Area ISCO System	1095 edays	16
19	Downgradient P&T System	6095 edays	16
20	**Biobarrier Injections**	**881 days**	
21	First Injection	30 edays	19SS+30 edays
22	Second Injection	25 edays	21FS+730 edays
23	Remedy Performance Monitoring	[illegible] edays	16
24	Site Closure Work Plan	30 days	23
25	Site Closure Sampling/Monitoring	365 edays	24FS+30 edays
26	Site Closure Monitoring Results Report	30 days	25
27	Receive Site Closure	0 days	26FS+45 edays
28	**OU 2 (Soil) RA**	**1820 days**	
29	**RA Solicitation**	**82 days**	
30	Post solicitation	30 days	
31	Receive proposals	0 days	30
32	Review solicitation proposals	10 days	31
33	Award Subcontract	0 days	32
34	Notice-to-Proceed	0 days	33FS+30 edays
35	Preparation of Draft Plans (RAWP, SAP, HASP)	60 days	34
36	Regulatory Agencies Review of Draft Plans	60 edays	35
37	Incorporate Comments and Submit Draft Final Plans	30 days	36
38	Regulatory Agencies Review of Draft Final Plans	60 edays	37
39	Incorporate Comments and Submit Final Plans	30 days	38
40	Permitting for RA (WDR, NPDES, Building Dept, etc)	90 edays	39FF
41	Installation of Remedy	30 days	40
42	Initial Startup and Testing	15 days	41
43	Full Scale O&M of RA Remedy	[illegible] edays	42
44	**Remedy STOP Evaluation**	**384 days**	
45	Site Closure Sampling/Monitoring	[illegible] edays	43
46	Submit Remedy STOP Report	0 days	44FS+60 days
47	Receive Approval to STOP OU 2 RA	0 days	46FS+45 edays



ATTACHMENT 5

TO UNILATERAL ADMINISTRATIVE ORDER 2009-07
IN THE MATTER OF A.G. LAYNE, INC., ET. AL.

STATEMENT OF WORK

STATEMENT OF WORK
FOR
REMEDIAL ACTION

AT THE

COOPER DRUM COMPANY SUPERFUND SITE
SOUTH GATE, LOS ANGELES COUNTY, CALIFORNIA

February 2009

TABLE OF CONTENTS

I. PURPOSE/INTRODUCTION

The purpose of this Statement of Work (SOW) for the Cooper Drum Company Superfund Site (site) is to implement the remedial actions (RAs) selected in the 2002 Record of Decision (ROD), and specified in the September 2007 remedial design (RD) reports for groundwater Operable Unit (OU) 1 and soil OU2. These two design reports were approved by the United States Environmental Protection Agency (EPA) on September 29, 2007, and shall be followed in implementing the RA at the site.

The Respondents must implement the RD by conducting the RA work, in compliance with the ROD, RD, any applicable EPA guidance, and this SOW for RA. The RA shall also be consistent with the RD/RA Handbook (EPA Office of Solid Waste and Emergency Response [OSWER] 9355.0-04B, EPA 540/R-95/059, June 1995). All relevant technical and decision documents for the site (including the RD reports for groundwater and soil) are found at the EPA Web site. Instructions for accessing the Web site and documents are in included in Section VI (References) of this SOW.

II. DESCRIPTION OF THE RA

The Respondents shall construct and operate the RAs selected in the ROD to meet the design criteria, drawings, specifications, Applicable or Relevant and Appropriate Requirements (ARARs), and other substantive requirements, criteria, and limitations set forth in the RD reports, the ROD, and this SOW.

The major components of the groundwater OU1 and the soil OU2 RAs for the Cooper Drum Company Superfund Site, which shall be constructed and implemented by Respondents, are summarized in Sections II.A and II.B, respectively.

A. Groundwater (OU1) RA

The groundwater RA includes remedial systems for the contamination plume source area and hydraulic control (containment) and treatment for the leading edge of the groundwater plume.

1. <u>Installation and Operation of Remediation Systems for the Groundwater Source Area:</u>

The source area is delineated by the composite 100 parts per billion (ppb) iso-concentration line for trichloroethylene (TCE), cis-1,2-dichloroethylene (cis-1,2-DCE), and 1,4-dioxane originating from the former Hard Wash Area (HWA). The Source Area RA comprises use of in situ chemical oxidation (ISCO) in conjunction with groundwater extraction, treatment, and injection.

Ozone (O_3) will be used as the primary oxidant during the ISCO activities. Hydrogen peroxide (H_2O_2) may also be used as a co-oxidant depending on site conditions and the results of the ozone-only injection.

Oxidant injection wells will be installed in the source area to form a permeable, V-shaped barrier to the groundwater. Additional components of the groundwater OU1 source area RA will include:

a. ISCO Injection Wells

Twelve new O_3/H_2O_2 injection wells (henceforth referred to as peroxone wells; denoted P_{ox}-1 through P_{ox}-12) will be installed in the source area. Three existing peroxone wells (M_{ox}-1, M_{ox}-2, and M_{ox}-3), previously used during the field treatability study, will also be utilized. A commercially available ISCO system will supply the O_3/H_2O_2.

New ISCO wells P_{ox}-1 through P_{ox}-12 will be installed to approximately 70 to 95 feet below ground surface (bgs). The oxidant injection depths will be 10 feet below the target groundwater contamination; however, the actual screen depth interval will depend on location-specific lithology. The peroxone wells will be sited/spaced approximately 50 feet apart depending on actual site conditions and the radius of influence (ROI). The peroxone injection wells will be installed in a "double V" or triangular-shaped pattern intersecting the groundwater flow direction and will mainly target the northern portion of the source contamination area close to the former HWA.

b. ISCO Delivery System

The remediation equipment will be capable of injecting both ozone and hydrogen peroxide. A commercial vendor will provide the ozone/hydrogen peroxide delivery equipment. This equipment consists of a trailer-mounted chemical oxidation system, which directs appropriate flow rates of ozone and hydrogen peroxide into peroxone wells fitted with prefabricated injection assemblies, as described above.

The trailer system will inject individual or variable combinations of air, oxygen, ozone, and hydrogen peroxide into the saturated zone. Each trailer-mounted ozone system will have the capability to deliver up to 130 pounds per day of up to 95% oxygen, which is sufficient for the ozone generator to produce up to 15 pounds per day of ozone. The system will be designed for ozone injection rates of 2 pounds per day per injection well (or 1 pound per day per injection interval). The design will allow for modification of the ozone injection rate, pending observed system performance.

At the estimated design rate of 2 pounds per day of ozone per injection well, for 15 injection wells, two such systems are required for providing adequate ozone. A standard chemical feed pump will deliver the hydrogen peroxide from a tank storing approximately 150 gallons of up to 35% strength hydrogen peroxide. An air compressor with a port gas delivery manifold will provide up to 18 standard cubic feet per minute (scfm) of compressed air at 120 pounds per square inch (psi). The trailer-mounted ISCO delivery system will include a 24-port gas/ chemical delivery manifold with 0.25-inch stainless steel solenoid valves for pulsing oxygen, air, ozone, and/or hydrogen peroxide into the injection wells. The injection process will be controlled through an integrated programmable logic controller (PLC) system that controls valve sequencing and activates all audio/

visual alarms. A call-out modem will be included for reporting the system operational status.

The ISCO remediation equipment will be housed in a closed warehouse located along Rayo Avenue, adjacent to the treatment compound.

ISCO system operation is anticipated to continue for three years, after which the capture and treatment of the residual contaminants in groundwater will be addressed by the extraction/treatment system.

c. <u>Extraction of groundwater downgradient of the ISCO Barrier</u>

Aboveground treatment and injection of extracted groundwater upgradient of the ISCO barrier will include:

<u>Extraction Well</u>

An extraction well, installed downgradient of the ISCO barrier, will provide hydraulic control in the source area, and maximize groundwater flow through the permeable barrier. The placement of the extraction well will be geared toward capture of the 10 ppb isoconcentration contour for 1,4-dioxane and any portions of the source area plume that lie beyond the ISCO system area of influence. The total depth of the source area extraction well will be approximately 105 feet bgs. The well will be screened from 60 to 100 feet bgs. In addition, there will be a 5-foot-deep sump will bring the total depth to 105 feet bgs. The design flow rate of the extraction well will be 25 gallons per minute (gpm).

<u>Groundwater Treatment System</u>

Extracted groundwater will be treated aboveground in a volatile organic compound (VOC) and 1,4-dioxane advanced oxidation process unit also used for cleanup of the perched aquifer groundwater as part of the Soil OU2 RA. A liquid-phase granular activated carbon (LGAC) unit also will be used as required, to further polish the treated water.

The overall design flow rate of the treatment system will be 30 gpm: 5 gpm from the perched aquifer and 25 gpm from the source area extraction well. The treated groundwater will then be injected into the shallow Gaspur Aquifer via two injection wells.

The treatment compound will be placed on site, close to the warehouse housing the ISCO trailer systems. Operation and maintenance of the system will continue beyond the three years anticipated for the ISCO systems.

<u>Groundwater Injection Wells</u>

The extracted and treated groundwater will be injected into two injection wells, at a rate of 15 gpm each, placed upgradient of the ISCO barrier. The total depth of the injection wells will be 85 feet bgs and each will be screened from 55 to 85 feet bgs. The two wells will be able to inject water at up to 30gpm: with up to 25 gpm coming from the source area extraction wells, and up to 5 gpm from the dewatering of the perched aquifer (as part of the soil RA).

2. Installation of Remediation Systems for Downgradient Containment and Treatment

The downgradient groundwater containment and treatment RA includes extraction of groundwater at the leading edge of the groundwater contamination plume and the use of an in situ permeable bioremediation barrier (for enhanced reductive dechlorination) to expedite remediation of a portion of the plume between the source area system and the downgradient containment and treatment system. (The RA described herein is based on information that was known about the contaminant plume as of September 2007, the publication date of the final RD report. Addenda Nos. 1, 2, and 3 of the *Remedial Design Technical Memorandum for Field Sampling Results* (Section VI, Site Documents) include the latest downgradient plume information. However, it should be noted that additional monitor wells have been installed since the RD report was finalized, and certain details of the RA, including well locations and the requirements for groundwater treatment, may have to be re-visited as more data become available.) The additional data from the new monitor well installations is expected to be available June 2009 in Addendum No. 4, and will also be available on the EPA Web site.

a. Downgradient Groundwater Extraction

Two groundwater extraction wells (designed to extract approximately 20 gpm each) will be installed at the leading edge of the 5 ppb TCE groundwater plume (currently thought to be just south of McCallum Avenue). The placement and operation of the groundwater extraction wells are designed to minimize the impact of adjacent plumes, while also providing hydraulic control of the groundwater through the permeable bioremediation barrier. The wells will be installed to a total depth of approximately 115 feet bgs. The wells will be screened from approximately 65 to 112 feet bgs.

The current design would convey extracted groundwater via piping to the on-site groundwater treatment compound; however, a final determination as to whether conveyance and treatment of this water will be required cannot be made until the extraction wells are installed and pump tests are performed. At that time, the analytical test results of water samples collected from the extraction well pump tests will be used to determine treatment requirements.

b. In situ Bioremediation

A 350-foot-long permeable bioremediation barrier (currently targeted to be placed along Southern Avenue) will also be installed upgradient of the extraction wells to enhance reductive dechlorination of VOCs in groundwater, as it flows across the barrier. The barrier will consist of injection of a reductive dechlorination enhancing substrate into approximately 180 borings drilled down to 100 feet bgs. The substrate injection depth interval will be approximately 80 to 100 feet bgs.

The RD assumes that performance-monitoring results, obtained over a two-year period following substrate injection, will be used to determine if a follow-up substrate injection event is necessary.

B. Soil (OU2) Remedial Action

The soil RA is divided by affected media: soil vapor (gas), perched groundwater, and soil. The vadose zone (unsaturated) soil and perched groundwater (occurring between the approximate depths of 35 and 40 feet bgs) are impacted in two areas of the site: the former HWA and the drum processing area (DPA).

Two depth intervals will require RA as follows:

- Readily accessible surface to near-surface soils (down to approximately 5 feet bgs) impacted with non-VOCs above action levels will be excavated.
- Non-VOC impacted soils under existing buildings and/or located greater than 5 feet bgs will be protected by implementing institutional controls.
- Deeper soils impacted with VOCs, and perched groundwater impacted with VOCs and 1,4-dioxane, will be remediated using dual-phase extraction (DPE).
- DPE will be performed prior to excavation of the shallow soils.

1. <u>Installation and Operation of DPE System for Soil Vapor and Perched Aquifer</u>

DPE will be used to simultaneously extract soil vapors and dewater the perched aquifer, which in turn expands the effect of soil vapor extraction (SVE) in the dewatered zone. The duration of DPE activities will depend on the time required to reach soil gas cleanup levels but is estimated to be approximately three years.

Extracted soil vapor will be treated at an on-site treatment system, using catalytic oxidation, followed by acid scrubbing. When influent vapor concentrations decrease to below approximately 150 parts per million by volume (ppmv) the emission controls system will be switched to granular activated carbon (GAC).

a. <u>Dewatering of the Perched Aquifer</u>

DPE will be used to dewater the perched aquifer, which is continuous beneath the HWA and DPA. The extracted water from the perched aquifer, at an estimated design rate of 5 gpm, will be conveyed to the groundwater treatment compound (see Section II.1.A) where it will be treated in an advanced oxidation process unit (mainly to treat 1,4-dioxane), followed by an LGAC polishing unit. The treated groundwater then will be discharged via two mechanisms: injection (using two injection wells located in the vicinity of the HWA and described in Section II.A.1) into the impacted shallow aquifer, and discharge to the sanitary sewer. (The same treatment and discharge sequence will be used to treat extracted water from the impacted Gaspur Aquifer as part of the groundwater RA; therefore, the water from the two aquifers will be indistinguishable during treatment and discharge processes.)

b. <u>DPE and Vapor Monitor Wells</u>

Two existing SVE wells and four existing vapor-monitoring points are incorporated in the RD. However, each existing SVE well will be converted to a DPE well by installing a submersible pump (lowered to the perched aquifer) within approximately the first 5 feet of the SVE well screen interval. Inside each DPE well, extracted water will be conveyed via a water outlet and extracted vapor will be transferred via a vapor outlet to the treatment compound. This same design will be used for new DPE well construction. SVE tests at the site indicate that the SVE ROI is approximately 55 feet. Based on this ROI estimate, using the 1,000 parts per billion by volume (ppbv) composite soil gas and the VOC plume as a conservative boundary for the area requiring RA, seven new DPE wells will be needed (five new wells in the HWA and two new wells in the DPA). The SVE depth interval will be approximately 10 to 30 feet bgs. The vapor extraction well design extraction rate is 50 cubic feet per minute (cfm). Additionally, a 0.5 horsepower (hp) submersible pump will be used in each new well yielding a 0.5 to 1.0 gpm water extraction rate per well.

The RA also includes installation of 13 new vapor monitor wells (9 in the HWA and 4 in the DPA), mostly within 25 to 50 feet from the SVE wells, with monitoring depths at 10, 20, and 30 feet bgs.

c. <u>Treatment Compound</u>

The DPE treatment compound will be comprised of the following components:

An SVE treatment system, an ex situ groundwater treatment system, and a 25-foot by 30-foot concrete pad (6-inch slab with edge footing) with secondary containment are the primary components. The pad will be designed for Seismic Zone 4 and will have an approximately 120-foot-long exterior, 8-foot-high chain-link fence with vinyl security slats, one standard 12-foot gate, and a one-man gate.

The SVE blower will have a capacity of 250 cfm at 10 inches of mercury (in-Hg), a knockout pot and catalytic oxidizer (CatOx), and a quench and acid gas scrubber air emission control system (condensate to be sent to treatment system).

Groundwater extracted as part of dual-phase operations will be sent to an equalization tank and then pumped into an ex situ ozone and hydrogen peroxide treatment system. Prior to discharge/reinjection, groundwater will be sent through two LGAC vessels to remove any remaining contaminants to levels below discharge limits.

2. Soil Excavation and Off-Site Transport

The RA includes the removal of site surface and near surface soils impacted with non-VOCs at concentrations exceeding the remedial action objectives (RAOs)

Initial soil removal activities will include excavation of four areas (two areas each in the HWA and DPA) to a maximum excavation depth of 5 feet bgs. Excavation will be conducted to 5 feet bgs to prevent direct exposure to near surface contaminated soil. Confirmation soil samples will be collected from the excavation floors and walls on 20-foot and 40-foot intervals, respectively. Soil samples will also be collected on excavation perimeters to confirm that the surface contamination surrounding the excavation is below established cleanup levels. Pending the confirmation sampling analytical results, additional excavation of site soils may be necessary. After the soils have been characterized, the excavation subcontractor will load nonhazardous (e.g., Class II) contaminated soil and concrete/debris into end-dump trucks for transportation to the designated Class II disposal facility. Any hazardous or Class I soil will be loaded into roll-off bins or trucks, manifested, and transported to the designated Class I disposal facility.

All excavated areas will be backfilled with clean soil material. However, for contaminated soils deeper than 5 feet which remain in place, the ROD allows, "implementation of institutional controls for soil contaminated with non-VOCs in areas where excavation is not feasible, such as under existing structures."

3. Institutional Controls

Removal of non-VOCs to the health-based cleanup levels will protect receptors at or near the site during ongoing and future activities. However, institutional controls will be implemented for soil contaminated with non-VOCs in areas where excavation is not feasible, such as under existing structures. Therefore, hazardous waste will remain at the property at levels not suitable for unrestricted use of the land. In this case, institutional controls will be implemented in the form of a state Land Use Covenant with the property owner. The Covenant shall conform with the requirements pursuant to Civil Code Section 1471, Health and Safety Code Section 25355.5, and the California Code of Regulations, Title 22, Section 67391.1.

III. PERFORMANCE STANDARDS

The Respondents shall meet all RAOs and ARARs set forth in the ROD.

To the extent practicable, Respondents shall also meet the design goals (e.g., groundwater extraction and injection rates, ISCO system design parameters, ISCO injection rates, SVE rates, and excavation volumes) established in the RD design documents for groundwater (OU1) and soil (OU2). Specifically with respect to groundwater, the RA shall provide sufficient hydraulic control of contaminated groundwater and added reagents (i.e., in situ chemical treatment), without increasing the potential for commingling with off-site groundwater plumes.

The RAOs for Cooper Drum, as stated in the ROD, are to protect human health and the environment from exposure to contaminated soil, groundwater, indoor air, and to restore the site's groundwater potential beneficial use as a drinking water source. The ROD-selected remedy meets these RAOs through treatment of soil and groundwater contaminated with contaminants of concern (COCs). The RAOs also serve to facilitate the five-year review determination of protectiveness of human health and the environment.

The RAOs for Cooper Drum are listed below:

<u>Groundwater</u>

Restore the groundwater through VOC treatment to drinking water standards (i.e. maximum contaminant levels [MCLs]).

<u>Soil</u>

Remediate soil COCs to prevent contaminants from migrating into groundwater at levels which would exceed drinking water standards.

Where feasible, remediate non-VOC contaminated soil above health-based action levels protective of ongoing and potential future site uses.

<u>Indoor Air</u>

Remediate soil and groundwater COCs (VOCs) to health-based action levels to eliminate potential exposures to indoor air exposure.

The RAOs were formed based on the following:

Reasonable anticipated land use scenarios used in the human health risk assessment that include continuation of heavy industrial land use and the possibility of future development for on-site residential land use.

The continuing contaminant threat to the aquifer (identified as a potential drinking water source) posed by soil contaminants underlying Cooper Drum.

The human health risk assessment identifying COCs, driving the need for RA (risk drivers) that is protective of human health.

The ROD specifies the following RD strategy for remediation of OU1 contaminated groundwater at the site:

- A combination of methods will be used to achieve VOC remedial goals and restore the site's groundwater beneficial use as a potential drinking water source.
- A groundwater extraction/treatment system will be used for containment and remediation.
- Chemical in situ treatment will also be used to enhance the treatment of VOCs in groundwater, minimize the need for extraction, and reduce the potential for other VOC plumes in the vicinity to impact Cooper Drum.

The ROD specifies the following RD strategy for remediation of OU2 contaminated soil:

- To remove the potential threat to human health, the selected remedy for soil will use DPE for treatment of VOCs in soil.
- Other non-VOC soil contaminants, including polycyclic aromatic hydrocarbons (PAHs), polychlorinated biphenyls (PCBs), and lead (an inorganic contaminant) will be excavated for disposal.
- Institutional controls will be implemented to prevent exposure to soil contaminants where excavation is not feasible.

Cleanup Levels

A summary table of the groundwater and soil COCs and cleanup levels is included as Attachment A and discussed below.

Groundwater (OU1)

Twelve hazardous substances are COCs in OU1 groundwater: 1,2,3-trichloropropane (TCP); TCE; 1,2-dichloroethane (DCA); vinyl chloride (VC); 1,2-dichloropropane (DCP); 1,1-DCA; cis-1,2-DCE; tetrachloroethene (PCE); trans-1,2-DCE; benzene; 1,1-DCE; and 1,4-dioxane.

Except for 1,4-dioxane, which is a semi volatile organic compound (SVOC), all other COCs are VOCs. As stated in the ROD, the RAO for groundwater is restoration of the groundwater (through treatment) for beneficial use as a potable water supply. Therefore, the cleanup goal for the majority of the site VOCs is the MCL. However, the cleanup goal for 1,2,3-TCP (for which an MCL has not been defined) is to achieve the practical quantification limit (PQL).

Post-ROD supplemental investigations of the site indicated the presence of elevated levels of 1,4-dioxane in the perched aquifer and shallow groundwater, therefore, a cleanup goal for 1,4-dioxane was not specified in the ROD. Currently, the drinking water preliminary remediation goal (PRG) for 1,4-dioxane (6.1 micrograms per liter [μg/L]) is being used as the cleanup goal.

Soil (OU2)

The ROD identifies the VOCs and non-VOCs as COCs in soil.

The ROD specifies the cleanup goals for VOCs as "to be determined (TBD)," pending collection of soil gas samples after implementation of the RA. The soil gas concentrations are to be used in the VLEACH (or comparable) model to predict impacts to groundwater, and in the Johnson and Ettinger model to estimate indoor air concentrations. Remediation of soil gas is to continue until predicted impacts to groundwater are at levels less than drinking water standards, and predicted indoor air concentrations are less than levels that would pose an unacceptable human health risk.

The ROD specifies the cleanup goal for PCBs in soil as 870 ppb. This level was back calculated by applying residential exposure parameters used in the site human health risk assessment and a target health risk level of 1 in 100,000. The ROD also describes the cleanup level for PAHs in soil as being based on the upper tolerance limit background benzo(a)pyrene-toxicity equivalent (B(a)P-TE) concentration for the Southern California PAH data set, which is 900 ppb B(a)P-TE. Finally, the ROD specifies a cleanup goal for lead of 400 parts per million (ppm) based on lead uptake in children.

IV. LIST OF DELIVERABLES AND OTHER TASKS

The Respondents shall submit plans, specifications, and other deliverables for EPA review and/or approval, as specified below. The supporting plans in Section N (i.e., Site Management Plan [SMP], Sampling and Analysis Plan [SAP], etc.) must be completed and approved by EPA before any field activities begin on the site. EPA may also request periodic updates of selected deliverables (e.g., work plan, sampling plan, monitoring plans, etc.) described in this section of the SOW, as more information is gathered or as conditions change during implementation of the RA. One copy of each final deliverable shall be provided in an unbound format suitable for reproduction and additional copies shall be provided as requested by the EPA. Information presented in color must be legible and interpretable when reproduced in non-color. At EPA's request, final deliverables shall also be provided in an electronic format.

The Respondents shall implement quality control procedures to ensure the quality of all reports and submittals to the EPA. These procedures shall include but are not limited to, internal technical and editorial review, independent verification of calculations, and documentation of all reviews, problems identified, and corrective actions taken.

As described in the Unilateral Administrative Order, the EPA may approve, disapprove, or modify each deliverable. Major deliverables, described below, shall be submitted according to the schedule in Section V of this SOW.

A. Project Planning

The Respondents shall meet with the EPA Remedial Project Manager (RPM) during the project-planning phase to assist in developing a conceptual understanding of the RD/RA requirements for the site. Information developed during this meeting shall be used to plan the project and to determine the extent of the additional data necessary to implement the RD/RA. It will be necessary to review the existing groundwater and soil data for the site in the project planning stage.

B. Remedial Action Work Plans

The RA will be conducted in three phases. Phase I will consist of preparing two separate work plans for remediation of VOCs in the soil and groundwater source area. Phase 2 and 3 will consist of preparing a single work plan for each phase. The Respondents shall submit the four RA Work Plans, describing the strategy of work for construction and operation of the RA for soil (OU2) and groundwater (OU1). The four work plans will be as follows:

- The Phase 1 RA Work Plans shall include details for the OU2 Dual Phase Extraction (DPE) System (DPE Work Plan) and the OU1 Groundwater Source Area System (GSA Work Plan);

- The Phase 2 RA Work Plan shall include details for the OU1 Downgradient Containment and Treatment System (DCT Work Plan); and
- The Phase 3 RA Work Plan shall include details for the OU2 Soil Excavation and Disposal and Institutional Controls (Soil E/IC Work Plan).

The RA Work Plans must be reviewed and approved by EPA. Each Work Plan shall include:

1. <u>Project Description</u>

Closely following the RD reports for groundwater (OU1) and soil (OU2), the RA Work Plans shall include a description of the work to be implemented by the Respondents.

Phase 1 - The DPE Work Plan (WP) will include details for implementation, installation and operation of the OU2 DPE system for treatment of VOCs in soil and the GSA WP will include details for implementation, installation and operation of the OU1 source area treatment system (i.e., ISCO injection wells, ISCO delivery system, groundwater extraction well, groundwater treatment system, and groundwater injection wells) and preparation of the Soil Vapor and Groundwater Monitoring Plans and all other supporting plans. The designs for both systems utilize the same equipment for the treatment and reuse components.

Phase 2 - The DCT WP shall also include details for the implementation, installation, and operation of the OU1 Downgradient Containment and Treatment System (i.e., groundwater extraction wells, groundwater treatment system, and in situ bioremediation barrier) and preparation of the Groundwater Monitoring Plan and all other supporting plans.

Phase 3 - The Soil E/IC WP shall include details for implementation of excavation and disposal of non-VOCs in soil, and institutional controls for soil contaminants that may be left in place.

2. <u>Description of the Responsibility and Authority of All Organizations and Key Personnel Involved With the Remedial Action.</u>

Each RA Work Plan shall include a description of the responsibilities and qualifications of key personnel expected to direct or play a significant role in the RD, RA, or treatment systems operation and maintenance (O&M), including Respondents' project coordinator, designer, construction contractor, construction quality assurance personnel, and resident engineer. The Work Plan shall define lines of authority and provide brief descriptions of duties.

3. <u>Schedule</u>

Each RA Work Plan shall identify the initiation and completion dates for each required construction activity, inspection, and deliverable required by the SOW schedule (Section V). Each Work Plan shall also identify the approximate timing of meetings and other activities that may require EPA participation, but are not identified in Section V of this SOW.

The schedule shall include monthly coordination meetings. Meeting frequency may be decreased as deemed appropriate by EPA. The coordination meetings shall address project status, problems, solutions, and schedule. A representative of the Respondents shall prepare a meeting summary to document all decisions made, issues outstanding, schedule changes, planned follow up, and assignments.

4. Contracting Strategy and Construction Process

Each RA Work Plan shall briefly describe the planned contracting strategy, including a brief description of the EPA evaluation and approval process for both minor and significant construction changes.

5. Plans for Satisfying All Permitting Requirements and Acquiring Property, Leases, Easements, or Other Access.

Each RA Work Plan shall list all permits, property, leases, and easements required for implementation of the RA; permits, property, leases, and easements acquired to date; and a schedule for submittal of permit applications and acquisition of property, leases, or easements not yet obtained.

Where normally required, permits must be obtained for all off-site activities, such as from the California Department of Public Health for domestic use of treated groundwater. The Respondents are not required to obtain permits for on-site remedial activities, but must comply with all substantive requirements, including local building codes. If permits will not be obtained for an on-site activity where a permit is normally required, the Respondents shall describe all consultative or coordination activities planned to identify and satisfy the substantive requirements.

6. Third Parties Necessary for Construction, or Operation and Monitoring of the RA

Each RA Work Plan shall describe the roles and responsibilities of Respondents, the County, the City, and participating water and wastewater agencies, and other parties expected to play a significant role in the construction or operation of the RA. The Work Plan shall summarize and provide copies of Memorandums of Understanding and draft or final agreements with other third parties expected to participate in implementation of the RA. If legally binding agreements are not in place, the Work Plan shall describe commitments made to date and planned efforts to secure necessary commitments including a schedule. If the participation of a third party is uncertain, the Work Plan shall describe alternatives to be implemented in the event that the party does not fulfill its planned role. Schedules that rely on the participation of third parties must include contingencies with equivalent schedules which do not rely on third party participation. Possible third party roles include agreeing to the use of existing equipment (e.g., groundwater extraction wells, water treatment facilities, pipelines, and groundwater recharge facilities), treatment plant operation, and acceptance of treated groundwater.

7. Identification of Any Concerns about the Quantity, Quality, Completeness, or Usability of Water Quality or Other Data Upon Which the Design Was Based

Respondents shall provide a description of additional data collection efforts, if any, required for completion of the RD. Respondents shall consider whether any data are needed to verify that critical design assumptions remain valid (e.g., the groundwater extraction and injection rates required for hydraulic control of the source area plume, soil areas requiring excavation, etc.). If additional data are required, Respondents shall propose a schedule for preparation of a SAP (or Addendum) and implementation of the SAP. The Plan shall include all efforts (e.g., groundwater modeling) to evaluate additional data collected.

8. Description of Planned Community Relations Activities to Be Conducted During RA

Respondents shall cooperate with the EPA and the State of California Department of Toxic Substances Control ("State") in providing community relations support work. As requested by the EPA or the State, the Respondents shall support the preparation of such information (e.g., graphics and data for EPA-produced fact sheets) for dissemination to the public to explain activities at or relating to the site. This support shall be at the request of the EPA and may include:

a. Logistical support for public informational or technical meetings, including the provision/copying of presentations, signage, exhibits, visual aids, and equipment; renting and setting up meeting locations, and English translation support at public meetings;

b. Publication and copying of fact sheets or updates, and document translation;

c. Assistance in placing the EPA-generated public notices in print; and

d. Logistical support for EPA-conducted community interviews.

9. Updates to the RA Work Plans and Periodic Reporting to the EPA

Each RA Work Plan shall describe provisions for reporting progress to the EPA (consistent with the schedule included in Section V of this SOW and the Groundwater (OU1) and Soil (OU2) Monitoring Plans. The RA Work Plans shall also describe the process of future updates as needed to document changes or provide information not available at the time of submittal.

If any requested information is not known at the time the RA Work Plan must be submitted, and omitting information from the Work Plan will not prevent compliance with any other requirements of this SOW, the Respondents may submit the information at a later date. If any information is omitted, the Respondents shall note in the Work Plan that the missing information was not available and specify a submittal date.

C. Preconstruction Meeting

A preconstruction meeting shall be held after selection of the construction contractor and before initiation of construction. The meeting shall include the Respondents' representatives and interested federal, state and local government agency personnel to define the roles, relationships, and responsibilities of all parties; review work area security and safety protocols access issues construction schedules; and construction quality assurance procedures.

The Respondents shall ensure that the results of the preconstruction meetings are documented and transmitted to all parties in attendance including the names of people in attendance, the issues discussed, all clarifications made, and any/or instructions issued.

D. Remedial Action Construction

Respondents shall implement the EPA approved RA Work Plan.

E. Pre-Final Construction Inspection

Within 14 days of Respondents belief that construction of a remedy component is complete, and the RA or a discrete portion of the RA has been implemented consistent with all aspects of the plans and specifications and is operating as designed, the Respondents shall notify the EPA and the state for the purposes of conducting a pre-final inspection. The EPA and the Respondents shall attend the inspection. Other participants shall include the project coordinator and other federal, state, and local agencies with a jurisdictional interest. If a pre-final construction inspection is held for a portion of the RA, one or more additional inspections shall be conducted so that the entire RA is inspected.

The objective of the inspection is to determine whether construction is complete and the RA (or the inspected portion) is operating as designed. Any outstanding construction items discovered during the inspection shall be identified and noted. Respondents shall certify that the equipment is effectively meeting remedial action performance specifications. Retesting shall be completed where deficiencies are revealed. A Pre-Final Construction Inspection Report shall be submitted by Respondents, which outlines the outstanding construction items, actions required to resolve the items, completion dates for the items, and an anticipated date for a final inspection. The Pre-Final Construction Inspection Report can be in the form of a bullet list or letter.

F. Final Construction Inspection

Within 21 days after completion of any work identified in the Pre-Final Inspection Report, Respondents shall notify the EPA and the state for the purposes of conducting a final inspection. The final inspection shall consist of a walk-through inspection by the EPA and Respondents. The Pre-Final Inspection Report shall be used as a checklist with the final inspection focusing on the outstanding construction items identified in the pre-final inspection. Confirmation shall be made that outstanding items have been resolved.

Any outstanding construction items discovered during the inspection still requiring correction shall be identified and noted on a punch list. If any items are still unresolved, the inspection shall be considered to be a Pre-Final Construction Inspection requiring another Pre-Final Construction Inspection Report and subsequent final construction inspection.

G Remedial Action Construction Completion Report

As specified in the approved schedule of this SOW, after construction is completed on the entire RA, and the systems are operating as designed, the Respondents shall submit a Remedial Action Construction Report.

In each report, a registered professional engineer and Respondents' project coordinator shall state that the construction of the RA has been completed in accordance with the RA Work Plans submitted under this SOW. The written report shall provide a synopsis of the work defined in this SOW, describe deviations from the RA Work Plan, include as-built drawings signed and stamped by a licensed professional engineer, provide actual costs of the RA and O&M to date, and provide a summary of the results of operational and performance well monitoring completed to date. The report shall contain the following statement, signed by a responsible corporate official of the Respondents or the Respondents' project coordinator:

> "To the best of our knowledge, after thorough investigation, we certify that the information contained in or accompanying this submission is true, accurate and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations."

H. Remedial Action Report

As provided in Section IX of the Unilateral Administrative Order , an Interim Remedial Action Report will be prepared two-hundred and seventy (270) days after the EPA approval of the Remedial Action Construction Report or after Respondents determine that the remedy is functioning properly and performing as designed, which ever is earlier. In the report, a registered Professional Engineer and Respondents Project Coordinator shall certify that the Remedial Action is operating and functioning as intended. The written report shall provide a summary of the results of operational and performance monitoring completed to date and shall provide documentation to substantiate the Respondents certification in full satisfaction with the Order, including, but not limited to, relevant data presented in accordance with Sections IV.J (Performance Evaluation Reports) and IV.L (Quarterly Compliance Monitoring Reports) of this SOW. The report shall also describe deviations from the RA Work Plans. After EPA review, Respondents shall address any comments and submit a revised report.

As specified in Section IX of the Unilateral Administrative Order, within 45 days after the Respondents conclude that the RA has been fully performed and the cleanup goals as specified in the ROD have been attained, Respondents shall schedule and conduct a pre-certification inspection to be attended by EPA and Respondents. If after the pre-certification inspection Respondents still believes that the RA has been fully performed and the cleanup goals have been attained, Respondents shall submit a certification to EPA that all work has been completed. The Final RA Report is due 90 days after completion of the pre-certification inspection to EPA in accordance with Section IX of the Unilateral Administrative Order. The RA Report shall include:

a. A copy of the Final Construction Completion Report;

b. Synopsis of the work defined in this SOW and a demonstration in accordance with the monitoring plans that cleanup goals have been attained;

c. Certification that the remedial action has been completed in full satisfaction of the requirements of the Unilateral Administrative Order; and shall contain the following statement, signed by a responsible corporate official of the Respondents or the Respondents Project Coordinator:

> "To the best of our knowledge, after thorough investigation, we certify that the information contained in or accompanying this submission is true, accurate and complete. I am aware that there are significant penalties for submitting false

information, including the possibility of fine and imprisonment for knowing violations." and

d. A description of how Respondents will implement any remaining part of the EPA approved Operation and Maintenance Plan.

After EPA review, Respondents shall address any comments and submit a revised report. As provided in Section IX of the Unilateral Administrative Order, the Remedial Action shall not be considered complete until EPA certifies in writing that the Remedial Action has been performed in accordance with the Unilateral Administrative Order.

I. Operation and Maintenance

O&M shall be performed in accordance with the Operation and Maintenance Manual approved by EPA for each RA Work Plan, except for the Phase 3 E/IC Work Plan. At ninety (90) days after initiation of construction for each RA, except soil excavation, the Respondents shall submit to the EPA a draft O&M Manual for review. Development of each manual should be based on the following: (1) the existing draft O&M manuals in the OU1 RD Report (see Appendix H) and the OU2 RD Report (see Appendix L), and (2) the guidelines described in "Operation and Maintenance in the Superfund Program" (OSWER 9200.1-37FS, EPA 540-F-01-004, May 2001) (http://www.epa.gov/superfund/policy/pdfs/sheet.pdf)

Each O&M Manual must be reviewed and approved by the EPA prior to initiation of O&M activities. If necessary, the Manual shall be modified to incorporate any design modifications implemented during the RA. Upon approval, Respondents shall implement each O&M Manual in accordance with the schedule contained therein. The O&M Manual shall describe an overview of the remedy and design philosophy, personnel, start-up procedures, operation, troubleshooting, training, and evaluation activities that shall be carried out by the Respondents and address the following elements:

1. <u>Equipment start-up and operator training including:</u>

   a. Technical specifications governing treatment systems;

   b. Requirements for providing appropriate service visits by experienced personnel to supervise the installation, adjustment, start-up and operation of the systems; and

   c. Schedule personnel training for appropriate operational procedures, once startup has been successfully completed.

2. <u>Description of normal operation and maintenance including:</u>

   a. Description of tasks required for system operation;

   b. Description of tasks required for system maintenance;

   c. Description of prescribed treatment or operating conditions; and

d. Schedule showing the required frequency for each O&M task.

3. Description of potential operating problems including:

   a. Description and analysis of potential operating problems;

   b. Sources of information regarding problems; and

   c. Common remedies or anticipated corrective actions.

4. Description of routine monitoring and laboratory testing including:

   a. Description of monitoring tasks;

   b. Description of required laboratory tests and their interpretation;

   c. Required quality assurance/quality control (QA/QC); and

   d. Schedule of monitoring frequency and date, if appropriate, when monitoring may cease.

5. Description of alternate O&M including:

   a. Should a system failure occur, alternate procedures to prevent undue hazard; and

   b. Analysis of vulnerability and additional resource requirements should a failure occur.

6. Safety Plan including:

   a. Description of precautions to be taken and required health and safety equipment, etc., for site personnel protection;

   b. Safety tasks required in the event of systems failure; and

   c. Emergency operating and response programs.

7. Community Involvement

   a. Description of community involvement process including notices of operational status, site tours and response to complaints.

8. Description of equipment including:

   a. Equipment identification;

   b. Monitoring components installation;

   c. Site equipment maintenance; and

d. Equipment and installation components replacement schedule.

9. <u>Permits, standards, and approvals</u>

10. <u>Records and reporting including:</u>

a. Daily operating logs;

b. Laboratory records;

c. Records of operating cost;

d. Mechanism for reporting emergencies;

e. Personnel and maintenance records; and

f. Monthly reports to state/federal agencies.

J. Groundwater Monitoring Plan

Monitoring activities shall be performed in accordance with the approved Groundwater Monitoring Plan, to evaluate whether the performance standards, as described in Section III of this SOW and in the ROD, are being met. The monitoring activities will include identifying performance monitor wells, monitoring from these wells and other monitor wells, extraction wells, and the treatment systems. The Groundwater RD Reports include sampling schedules for the OU1 groundwater monitor well programs (Table 4-1) and the Extraction and Treatment System Sampling (Table 4-2). A revised SAP will be prepared in support of all fieldwork to be conducted according to the Groundwater Monitoring Plan. As a result of the post-RD well installations and sampling, the Groundwater Monitoring Plan shall specify updated performance monitor well locations, sampling methods and a sampling frequency. Respondents shall review the sampling schedules in the RD Report and submit the Groundwater Monitoring Plan no later than the specified date in the approved schedule. The Groundwater Monitoring Plan shall address the following requirements:

1. <u>Data Collection Parameters</u>

The Respondents shall specify the locations of monitor wells in the Gaspur and Exposition Aquifers. Respondents shall specify sampling and monitoring methods and a sampling and monitoring frequency.

It is expected that, initially, all groundwater monitor wells will be sampled quarterly. As concentrations decline, the sampling frequency is expected to change as follows:

a. Quarterly – groundwater concentrations greater than cleanup goals;

b. Semiannually – groundwater concentrations less than cleanup goals during the previous sample event;

c. Annually – groundwater concentrations less than cleanup goals for two consecutive sample events; and

d. Confirmation sampling – if groundwater concentrations remain less than cleanup goals for three consecutive sample events.

If concentrations increase above cleanup goals at any time, the well shall resume the quarterly sampling frequency and follow the process listed above.

2. Computer Modeling

The Respondents shall perform hydraulic and contaminant transport modeling simulations of groundwater flow and contaminant migration to help determine whether the RA will sufficiently contain the groundwater contamination during all anticipated pumping and recharge conditions (i.e., demonstrating that simulated particles originating in contaminated areas converge into the extraction wells) while minimizing the potential for plume commingling. The Respondents shall also propose and evaluate modifications to the extraction plan, if needed, using an appropriate three-dimensional, time-varying model of groundwater flow. When establishing extraction capture zones, the Respondents shall follow the guidelines described in "A Systematic Approach for Evaluation of Capture Zones at Pump and Treat Systems" (http://www.epa.gov/ada/download/reports/600R08003/600R08003.pdf).

The Groundwater Monitoring Plan shall describe the model calibration approach and assumptions. All models must be calibrated by Respondents and approved by EPA prior to use.

3. Split Sampling

The Groundwater Monitoring Plan shall specify procedures for coordination of the EPA or State collection of split or replicate samples and water level measurements if the EPA or the State requests such samples.

4. Contingency Action

The Groundwater Monitoring Plan shall propose contingency plans to be used in the event that sampling results in the downgradient extraction wells or in monitor wells located on the eastern and southern portions of the plume indicate uncharacteristically large increases in COC concentrations, indicating further commingling with off-site plumes. Contingency actions could include increases in monitoring frequency, installation of additional groundwater monitor wells in the impacted areas, and adjustment of groundwater extraction rates.

5. Treatment System Monitoring

The Groundwater Monitoring Plan will also include treatment system monitoring. Treatment system monitoring and extraction well samples will be required during the system startup and routine operation to ensure proper operation of the remediation equipment, and to evaluate if cleanup goals have been reached. A description of the types of data to be collected from the treatment system, sampling, and data gathering methods, monitoring locations, sampling frequencies, and if appropriate, minimum monitoring duration, shall be identified.

6. Well Discharge

Respondents shall measure flow rates at each extraction well (and calculate volumes of water extracted) as a function of time, using a meter/totalizer installed on the discharge pipe for each extraction well. The reading on the meter/totalizer shall be recorded at least quarterly and whenever water quality samples are collected from that well.

7. Treatment Plant Effluent/Treated Groundwater

Respondents shall analyze treated water samples to verify attainment of groundwater treatment and discharge goals (i.e., at a minimum, MCLs, as stated in the discharge limits) and monitor operational parameters that are used as indicators of treatment facility performance or the need for maintenance. Respondents shall propose appropriate parameters and schedules for sampling of treated groundwater to ensure compliance with ARARs. After a period of initial monitoring, Respondents may propose criteria for subsequent reductions in sampling and/or analysis frequencies if the sampling results support such reductions.

8. Contaminant Mass Removal

Respondents shall calculate the mass of individual contaminants removed from the Gaspur Aquifer by each extraction well each quarter, and cumulatively.

9. Aquifer Testing

Respondents shall perform aquifer tests at new extraction wells and injection wells to estimate aquifer transmissivity in the vicinity of the wells.

10. Air Emissions and Soil Gas Monitoring

Respondents shall perform air emission monitoring to verify that air emissions from treatment operations do not exceed ARARs.

11. Data Analysis and Reporting

The Groundwater Monitoring Plan shall also describe how the performance data will be analyzed, interpreted, and reported to evaluate compliance with ARARs. All data shall be submitted by the deadlines specified in an agreed upon schedule. Claims of change, difference, or trend in water quality or other parameters (e.g., between observed values and an ARAR) shall include the use of appropriate statistical concepts and tests.

All analytical data, whether or not validated, shall be submitted to the EPA within 60 calendar days of sample shipment to the laboratory or 14 days of receipt of analytical results from the laboratory, whichever occurs first. All analytical data previously validated and in electronic format in an approved data structure, shall be submitted within 90 calendar days of the sample shipment to the laboratory. Well construction information shall be submitted at the completion of the initial sampling activities or within 90 days after completion of a well, whichever is earlier.

The Groundwater Monitoring Plan shall provide a brief description of the contents and format for the Performance Evaluation Reports (see Section L below) and propose electronic reporting formats to support submittal of all groundwater data to the EPA.

K. Soil Vapor Monitoring Plan

Soil vapor monitoring activities shall be performed in accordance with an approved Soil Vapor Monitoring Plan, to evaluate whether the performance standards, as described in this SOW and in the ROD, are being met. The monitoring activities will include monitoring from vapor monitor wells, SVE wells, and the vapor treatment systems. A revised SAP shall be prepared in support of all fieldwork to be conducted according to the Soil Vapor Monitoring Plan. The Soil (OU2) RD report includes recommended vapor monitor well locations (Table 5-5) and a summary of a typical sampling schedule for monitoring vapor wells, SVE wells, and treatment system (Table 5-6).

Respondents shall review the sampling locations and schedules presented in the RD report and submit the Soil Vapor Monitoring Plan no later than the specified date in the approved schedule. The Soil Vapor Monitoring Plan shall address the following requirements:

1. <u>Extraction Well and Vapor Monitor Well Sampling</u>

The Soil Vapor Monitoring Plan shall specify locations of the vapor monitoring and extraction wells, sampling and analytical methods, and, initially, a quarterly sampling frequency. The Soil Vapor Monitoring Plan shall provide a flow chart or decision logic for modifying the well sampling frequency as concentrations decline over time.

2. <u>Treatment System Monitoring</u>

The Soil Vapor Monitoring Plan shall include treatment system monitoring which will be required during system startup and operations to ensure proper operation of the proposed remediation equipment. A detailed example of a typical sampling schedule is presented in Table 5-6 of the Soil (OU2) RD report. The sampling frequency and parameters are typical for DPE systems. The system inlet and outlet will be monitored for VOCs, as well as for other emissions criteria, such as acid gas emissions produced during the oxidation of chlorinated compounds. The Permit to Operate issued by the South Coast Air Quality Management District, as well as other permits relevant to the groundwater RA issued by the Los Angeles County Sanitation District and/or the Los Angeles Regional Water Quality Control Board (RWQCB) Waste Discharge Requirement (WDR), may require additional parameters and monitoring frequencies. Therefore, the Soil Vapor Monitoring Plan shall defer to these permits for the sampling frequencies, parameters, and analytical methods.

3. <u>Treatment System Performance Sampling</u>

The system operators, with the help of the design engineers, will monitor long-term system performance including mass removed, discharge volumes, and run time efficiency. These data will allow for review of remedial process optimization (RPO), as necessary. The Soil Vapor Monitoring Plan should provide a list of the system parameters that will be monitored and evaluated to allow for RPO of the system.

As part of the RPO evaluation, the Soil Vapor Monitoring Plan shall also provide decision criteria for alterations to the system operation, for example, switching off the emission controls system from CatOx to vapor granular activated carbon (VGAC) as influent concentrations fall below approximately 150 ppmv. Additionally, decision criteria for shutting down of the SVE system shall be provided to evaluate rebound or to perform confirmation soil sampling.

4. Computer Modeling

With regard to the impact from soils to groundwater, the ROD specifies the cleanup goals for VOCs as "To Be Determined," pending collection of soil gas samples after implementation of the RA. The soil gas concentrations are to be used as initial concentrations in the VLEACH (or comparable) model to predict migration/impact to groundwater, and in the Johnson and Ettinger model to estimate indoor air concentrations (URS, 2002 [Cooper Drum RI/FS, Section 5.2]). Soil remediation will continue until predicted impacts to groundwater are at levels less than drinking water standards, and predicted indoor air concentrations are less than levels that would pose unacceptable human health risk. Therefore, the Soil Vapor Monitoring Plan shall specify the model, and model calibration approach, and any other assumptions to be used to evaluate soil gas impact to groundwater and indoor air.

5. Termination of SVE Operations and Confirmation Sampling

The Soil Vapor Monitoring Plan shall provide decision criteria for evaluating SVE system shut-down including data quality objectives (DQOs) and decision criteria for soil confirmation sampling.

L. Performance Evaluation Reports

Performance Evaluation Reports shall include all relevant data and information required to assess the success of soil and groundwater RAs in meeting the cleanup goals. Separate sections or volumes of the report shall be used to discuss soil and groundwater data. Performance Evaluation Reports shall be provided based on the schedule in this SOW. In general, the report should cover:

- Summaries of monitoring activities conducted since the previous reporting period: measured soil gas and groundwater contaminant concentrations at wells and at treatment system inlets and outlets; groundwater levels at monitor wells; charts showing contaminant concentrations and groundwater levels versus time; and any other relevant preliminary calculations and supporting data used to evaluate system performance.

- Water level contour maps showing the most recently measured water levels, capture zones for extraction wells; measured contaminant concentrations and associated contour maps; the interpreted extent of contamination; groundwater modeling results used to confirm groundwater capture (while minimizing commingling with off-site plumes), including a detailed description and explanation (if applicable) of improvements made to the computer model; and, extraction well zone of capture analysis, using the latest the EPA guidelines as described in *A Systematic Approach for Evaluation of Capture Zones at Pump and Treat Systems* http://www.epa.gov/ada/download/reports/600R08003/600R08003.pdf.

- Summaries of relevant operating and field data, including mass removal (current and cumulative); any preliminary calculations and supporting data used to evaluate system performance; descriptions of the nature of, duration of, and response to any operational problems or actions performed to optimize system/RA performance; and any other requirements outlined in the Soil Vapor Monitoring Plan.

- After completion of at least one quarterly site-wide monitoring event for groundwater and soil vapor, individual contaminant contour maps shall be prepared indicating the extent of the COCs with the highest concentrations (e.g., TCE, cis-1,2-DCE, 1,2-DCA, 1,1-DCA, VC, and 1,4-dioxane in groundwater; and PCE, TCE, cis-1,2-DCE, 1,2-DCA, 1,1-DCA, and VC in soil gas). Additional contour maps shall be prepared if requested by the EPA, to indicate the extent of contamination in additional depth intervals, or for additional contaminants. The assumptions made in averaging, excluding, truncating, or otherwise selecting or manipulating the data used in preparing the contour maps shall be clearly stated.

M. Progress Reports

The Respondents shall submit monthly progress reports and weekly construction activity reports, as specified in Section V of this SOW.

N. Supporting Plans

Before any field activities commence, the Respondents shall submit several site-specific plans to establish procedures to be followed by the Respondents in performing field, laboratory, and analysis work. These site-specific plans include:

- Site Management Plan,
- Sampling and Analysis Plan,
- Health and Safety Plan (HASP), and
- Construction Quality Assurance Plan.

The format and scope of each plan shall be modified as needed to describe clarifications to the sampling, analyses, and other activities as the RA progresses. The EPA may modify the scopes of these activities at any time during the RA.

1. <u>Site Management Plan</u>

The SMP shall describe how the Respondents will manage the project to complete the work required at the site. The overall objective of the SMP is to provide the EPA with a written understanding and commitment by the Respondents of how various project aspects such as access, security, contingency procedures, management responsibilities, waste disposal, budgeting, and data handling are being managed. Specific objectives and provisions of the SMP shall include, but are not limited to, the following:

a. Providing a vicinity map listing properties, property owners, and addresses of owners to whose property access may be required.

b. Providing a site map clearly indicating the exclusion zone, contamination reduction zone, and clean area for on-site activities.

c. Establishing the necessary procedures (e.g., sample letters) to land owners for arranging field activities and ensuring the EPA and the state are informed of access-related problems and issues.

d. Providing for the security of government and private property on the site.

e. Preventing unauthorized entry to the site which might result in exposure of persons to potentially hazardous conditions.

f. Securing access agreements for the site.

g. Establishing field office location for on-site activities.

h. Providing contingency and notification plans for potentially dangerous activities associated with the RA.

i. Monitoring airborne contaminants released by site activities which may affect the local populations.

j. Communicating to the EPA and the public the organization and management of the RA including key personnel and their responsibilities.

k. Providing a list of the Respondents contractors and subcontractors of activities and roles.

l. Providing regular financial reports of the Respondents' expenditures on the RA activities.

m. Providing for the proper disposal of materials used and wastes generated during the RA (e.g., drill cutting, extracted groundwater, protective clothing, disposable equipment, etc.). These provisions shall be consistent with the off-site disposal aspects of Superfund Amendments and Reauthorization Act (SARA), Resource Conservation and Recovery Act (RCRA), and applicable state laws. The Respondents, their authorized representative, or another party acceptable to the EPA shall be identified as the generator of wastes for the purpose of regulatory or policy compliance.

n. Providing plans and procedures for organizing, manipulating, and presenting the data generated and for verifying its quality before and during the RA. These plans shall include a description of the computer database management systems compatible with hardware available to the EPA Region 9 personnel for handling media-specific sampling results obtained before and during the RA. The description shall include data input fields, examples of database management output from the coding of all RA sample data, appropriate QA/QC to ensure accuracy, and capabilities of data manipulation. To the degree possible, the database management parameters shall be compatible with the EPA Region 9 data storage and analysis system.

2. Sampling and Analysis Plan

The Respondents shall prepare a SAP, or update an existing plan to perform monitoring and carry out any other field investigations needed to revise the RD, and construct and operate the RA. The SAP shall discuss the timing of data collection activities, including data collection activities needed to establish baseline conditions before start-up of the RA.

The SAP shall include a Field Sampling and Analysis Plan (FSP), a Quality Assurance Project Plan (QAPP), and a schedule for implementation of all field activities including but not limited to well installation, sampling, analysis, and reporting activities. The FSP and QAPP may be submitted as one document or separately, and may reference an existing FSP or QAPP. Upon the EPA approval, The Respondents shall proceed to implement the sampling activities described in the SAP.

a. The FSP shall describe sampling objectives, analytical parameters, sample locations and frequencies, sampling equipment and procedures, sample handling and analysis, management of investigation-derived wastes, and planned uses of the data. The FSP shall be consistent with *Preparation of an EPA Region 9 Field Sampling Plan for Private and State-Lead Superfund Projects* (Document Control No. 9QA-06-89, April 1990), and other applicable guidance. It shall be written so that a field sampling team unfamiliar with the project would be able to gather the samples and field information required.

b. The SAP (QAPP) shall conform to the EPA guidance and requirements as specified in the *Uniform Federal Policy for Quality Assurance Project Plans* (UFP-QAPP) EPA-505-B-04-900A, March 2005, and *Guidance on Systematic Planning using the Data Quality Objectives Process* (DQO) (QA/G-4) EPA/240/B-06/001, February 2006, or other QA guidance documents cited by the agency in specific task orders.

   The DQOs shall, at a minimum, reflect use of analytical methods for obtaining data of sufficient quality to meet National Contingency Plan requirements as identified at 40 Code of Federal Regulations (CFR) 300.435 (b).

   The Respondents shall demonstrate in advance, and to the EPA's satisfaction, that each laboratory used is qualified to conduct the proposed work and meets the requirements specified in Section XVI of this SOW. The EPA may require that the Respondents submit detailed information to demonstrate that the laboratory is qualified to conduct the work, including information on personnel qualifications, equipment and material specification, and laboratory analyses of performance samples (blank and/or spike samples). In addition, the EPA may require submittal of data packages equivalent to those generated by the EPA Contract Laboratory Program (CLP).

Upon the EPA approval, Respondents shall proceed to implement the sampling activities described in the SAP.

Electronic copies of the UFP-QAPP guidance document are available online: http://www.epa.gov/fedfac/pdf/ufp_qapp_v1_0305.pdf.

Copies of the DQO guidance can be obtained at http://www.epa.gov/quality, and regional QA guidance are available at http://www.epa.gov/region9/qa/.

3. Health and Safety Plan (HASP)/Contingency Plan

To ensure protection of on-site personnel and area residents from hazards posed during RA activities, including O&M, etc., Respondents shall also develop a HASP (or update an existing plan). The HASP shall be in conformance with U.S. Occupational, Safety, and Health Administration (OSHA) requirements as outlined in 29 CFR §§1910 and 1926, and any other applicable requirements. The HASP shall describe health and safety risks, employee training, monitoring and personal protective equipment, medical monitoring, levels of protection, safe work practices and safeguards contingency and emergency planning, and provisions for site control. The EPA will not approve Respondents HASP/Contingency Plan, but rather the EPA will review it to ensure that all necessary elements are included, and that the plan provides for the protection of human health and the environment. For the construction and O&M activities, the Respondents shall submit a draft Contingency Plan describing procedures to be used in the event of an accident or emergency at the site. The draft Contingency Plan shall be submitted with the RA Work Plan. The final Contingency Plan shall be submitted prior to the start of construction. The Contingency Plan shall include, at a minimum, the following:

- The name(s) of person(s) or entities responsible for responding to an emergency incident.
- The planned date(s) for meeting(s) with the local community, including local, state, and federal agencies involved in the RA.
- First-aid medical information.
- An air monitoring plan (if applicable).
- A Spill Prevention, Control, and Countermeasures (SPCC) Plan, as specified in 40 CFR Part 109, describing measures to prevent, and contingency plans for, potential spills and discharges from materials handling and transportation.

4. Construction Quality Assurance Plan

The Respondents shall develop and implement a Construction Quality Assurance Plan to ensure, with a reasonable degree of certainty, that the completed RA meets or exceeds all design criteria, plans and specifications, and performance standards. Generalized plans are provided in the soil and groundwater RD reports and can be used as a point of reference. The Construction Quality Assurance Plan shall include the following elements:

a. Responsibilities and authorities of all organizations and key personnel involved in the construction and operation of the RA and assigned QA/QC function.

b. A description of the QC organization, including a chart showing lines of authority, members of the QA team, their responsibilities and qualifications, and acknowledgment that the QA team will implement the quality control system for all aspects of the work specified and shall report to the Respondents' project coordinator and the EPA. Members of the QA team shall have a good professional and ethical reputation, previous experience in the type of QA/QC activities to be implemented and demonstrated capability to perform the required activities. They shall also be independent of the construction contractor.

c. A description of the observations, inspections, and control testing that will be used to assure quality workmanship, verify compliance with the plans and specifications, or meet other QC objectives during implementation of the RA. This includes identification of sample size, sample locations, and sample collection or testing frequency; and acceptance and rejection criteria. The Construction Quality Assurance Plan shall specify laboratories to be used, and include information which certifies that personnel and laboratories performing the tests are qualified and the equipment and procedures to be used comply with applicable standards.

d. A schedule for managing submittals, testing, inspections, and any other QA function (including those of contractors, subcontractors, fabricators, suppliers, purchasing agents, etc.) that involve assuring quality workmanship, verifying compliance with the plans and specifications, or any other QC objectives. Inspections shall verify compliance with all environmental requirements and include, but not be limited to, air quality and emissions monitoring records and waste disposal records, etc.

e. Reporting procedures, frequency, and format for QA/QC activities. This shall include such items as daily summary reports, inspection data sheets, problem identification and corrective measures reports, design acceptance reports, and final documentation. Provisions for the final storage of all records shall be presented in the Construction Quality Assurance Plan. The QA official shall report simultaneously to the Respondents' representative and to the EPA.

f. A list of definable features of the work to be performed. A definable feature of work is a task that is separate and distinct from other tasks and has separate QC requirement

V. SCHEDULE FOR MAJOR DELIVERABLES AND OTHER TASKS

ACTIVITY	DUE DATE
Effective Date of Unilateral Administrative Order (UAO)	March 19, 2009.
Notify EPA of Project Coordinator Selected (as required by Section XVIII)	Twenty-eight (28) [1] days after the effective date of the UAO.
Notify EPA of Project Manager selected (as required by Section IX of the UAO)	Forty-five (45) days after the effective date of the Unilateral Administrative Order.
Project Planning Meeting with EPA RPM	Thirty (30) days after EPA approval of selected Project Manager
Planning Documents	
Phase 1 RA - Dual Phase Extraction Work Plan (OU2 DPE WP) and Groundwater Source Area Work Plan (OU1 GSA WP)	One hundred and twenty (120) days after the effective date of the Unilateral Administrative Order. If necessary, revised Plan due within 14 days after receipt of the EPA comments.
Phase 2 RA - Downgradient Containment and Treatment System Work Plan (OU1 DCT WP)	Sixty (60) days after the Phase 1 RA Work Plans are approved for the OU2 DPE system and the OU1 Source Area System. If necessary, revised Plan due 14 days after receipt of the EPA comments.
Phase 3 RA - Soil Excavation and Disposal and Institutional Controls Work Plan (OU2 Soil E/IC)	Sixty (60) days after completion of the Interim Remedial Action Report for the OU2 DPE System. If necessary, revised Plan(s) due 14 days after receipt of the EPA comments.
Groundwater and Soil Vapor Monitoring Plans	Sixty (60) days after the EPA approval of each RA Work Plan. If necessary, revised Plan(s) due 14 days after receipt of the EPA comments.
Remedial Action	
Construction Bid Packages	Thirty (30) days after the EPA approval of RA Work Plan (the EPA review time of 28 days).
Selection of Construction Contractor	Sixty (60) days after issuance of bid packages.
Notify EPA of Construction Contractor selected	Within five (5) days of selection.

ACTIVITY	DUE DATE
Pre-Construction Meeting	Fourteen (14) days after the selection of Construction Contractor.
Initiate Construction	Thirty (30) days after Pre-Construction Meeting.
Complete Construction	Per schedule approved by EPA in the RA Work Plan
Pre-Final Construction Inspection	Fourteen (14) days after Respondents determine that all aspects of the plans and specifications for the RA have been implemented and are operating as designed.
Pre-Final Construction Inspection Report	Twenty-one (21) days after Pre-Final Construction Inspection.
Final Construction Inspection (if needed)	Twenty-one (21) days after Pre-Final Construction Inspection Report.
Final Construction Inspection Report (if needed)	Twenty-one (21) days after Final Construction Inspection.
As-Built Construction Drawings	Twenty-eight (28) days after Final Construction Inspection Report If needed, revised drawings fourteen (14) days after receipt of the EPA comments.
Remedial Action Construction Completion Report	Sixty (60) days after Final Construction Inspection Report. If needed, revised report due 28 days after receipt of the EPA comments.
Interim Remedial Action Report	Two-hundred and seventy (270) days after the EPA approval of the Remedial Action Construction Report or fourteen (14) days after Respondents determine that performance criteria for the RA are being met and the remedy is Operational and Functional, whichever is earlier. If needed, revised Report due twenty-eight (28) days after receipt of the EPA comments.
Pre-Certification Inspection for Completion of the Work	Forty-five (45) days after the Respondents conclude that all Work has been performed, including Operation and Maintenance activities, and cleanup goals attained.
Certification that all Work has been Completed	Thirty (30) days after the pre-certification inspection.
Final Remedial Action Report	Ninety (90) days after completion of the pre-certification inspection. If needed, revised report due 28 days after receipt of the EPA comments.
Operation and Maintenance[2]	
Operation and Maintenance Manuals	Ninety (90) days after construction of the RA is initiated. If requested by the EPA, revised Manual due twenty-one (21) days after receipt of the EPA comments.

ACTIVITY	DUE DATE
Operation and Maintenance Manuals (continued)	Updated Manual due fourteen (14) days after Final Construction Inspection to incorporate any design modifications made during RA (or written statement that update is unnecessary). If requested by the EPA, revised updated Manual due twenty-one (21) days after receipt of the EPA comments.
Performance Evaluation[2]	
Performance Evaluation Reports	Due every six (6) months, (or when RA satisfies Operational and Functional criteria, whichever is earlier) beginning ninety (90) days after the EPA approval of Groundwater and Soil Monitoring Plans.
Progress Reports	Due monthly, beginning sixty (60) days after effective date of the Unilateral Administrative Order. Due weekly during construction work, Construction Activity Progress Reports beginning when construction is initiated.
Supporting Plans[2]	
Site Management Plan	Submitted with any plan requiring field activities (i.e., RA Work Plans, Groundwater Monitoring Plan, etc.).
Sampling and Analysis Plan	Submitted with any plan requiring field activities (i.e., RA Work Plans, Groundwater Monitoring Plan, etc.).
Site Health and Safety Plan	Submitted with any plan requiring field activities (i.e., RA Work Plans, Groundwater Monitoring Plan, etc.).
Construction Quality Assurance Plan,	No later than the date of the RA Work Plan submittals.

1 - Days are calendar days.
2 - All deliverables under this section are required for each of the four Work Plans.

VI. REFERENCES

The following list, although not comprehensive, provides citations for many of the regulations and guidance documents that apply to the RD/RA process. Respondents shall review these guidance documents and shall use the information provided therein in performing the RA and preparing all deliverables under this SOW. Instructions for access to the EPA guidance documents referenced in the SOW are either included in the SOW or can be found by searching the EPA website using the specific reference provided below. The list also includes the technical documents produced for the Cooper Drum Company Site beginning with remedial investigation and going through to the RD (i.e., ROD, Groundwater [OU1] Remedial Design Report, etc.). Access to technical documents produced for the Cooper Drum Company Site are available online:http://yosemite.epa.gov/r9/sfund/r9sfdocw.nsf/vwsoalphabetic/Cooper+Drum+Co.?OpenDocument

After entering this Web site, scroll down to site documents and reports.

EPA Guidance Documents:

"Superfund Remedial Design/ Remedial Action Handbook," EPA, Office of Emergency and Remedial Response, June 1995 (EPA 540/R-95/059).

"EPA NEIC Policies and Procedures Manual," EPA, May 1978, revised May 1986.

"Guidance on Systematic Planning using the Data Quality Objectives Process (DQO)" EPA, February 2006, (EPA QA/G-4), EPA/240/B-06/001.

"Uniform Federal Policy for Quality Assurance Project Plans (UFP-QAPP)," EPA, March 2005 (EPA-505-B-04-900A).

"Preparation of a EPA Region 9 Field Sampling Plan for Private and State-Lead Superfund Projects," April 1990, EPA, (No. 9QA-06-89).

"Guidance on Remedial Actions for Contaminated Ground Water at Superfund Sites," EPA, Office of Emergency and Remedial Response (Draft), OSWER Directive No. 9283.1-2.

"Methods for Monitoring Pump-and-Treat Performance," EPA, Office of Research and Development, June 1994 (EPA 600/R-94/123).

"A Systematic Approach for Evaluation of Capture Zones at Pump and Treat Systems," EPA, January 2008 (EPA/ 600/R-08/003).

"Close Out Procedures for National Priorities List Sites," January 2000, EPA 540-R-98-016, OSWER Directive 9320-2-09A-P.

"Operation and Maintenance in the Superfund Program" (OSWER 9200.1-37FS, EPA 540-F-01-004, May 2001)

Site Documents:

United States Environmental Protection Agency (EPA), 2002. *Record of Decision, Cooper Drum Company, City of South Gate, California*. September

URS Group, Inc. (URS), 2002. *Cooper Drum Remedial Investigation Feasibility Study Report*. May

URS, 2005. *Final Results of HRC Field Pilot Study*. April.

URS, 2006. *Remedial Design Technical Memorandum for Field Sampling Results*. July.

URS, 2006. *Field Pilot Study of ISCO Using Ozone and Hydrogen Peroxide*. December.

URS, 2007. *Remedial Design Technical Memorandum for Field Sampling Results, Addendum No. 2 CPT/HydroPunch Sampling Results February/March 2007*. June.

URS, 2007. *Remedial Design Technical Memorandum for Field Sampling Results, Addendum No. 1 Groundwater Monitoring Report August 2006*. March.

URS, 2007. *OU1 Groundwater Remedy Conceptual Design, Cooper Drum Company Site, South Gate, CA*. May.

URS, 2007. *Soil Remedial Design Report Operable Unit 2 Cooper Drum Company Superfund Site*. September.

URS, 2007. *Groundwater Remedial Design Report Operable Unit 1 Cooper Drum Company Superfund Site*. September.

URS, 2008. *Remedial Design Technical Memorandum for Field Sampling Results, Addendum No. 3 Monitor Well Installation and Groundwater Sampling Results*. September.

ATTACHMENT A

TABLE A-1

Cleanup Levels for Contaminants of Concern
Cooper Drum Company Superfund Site

Medium	Contaminant of Concern	Cleanup Level	Basis for Cleanup Level	Risk at Cleanup Level
Soil (VOCs)	1,1-Dichloroethane (1,1-DCA)	Leachate <MCL[a]	VLEACH modeling	TBD
	1,1-Dichloroethene (1,1-DCE)	Leachate <MCL	VLEACH modeling	TBD
	1,2-Dichloroethane (1,2-DCA)	Leachate <MCL	VLEACH modeling	TBD
	1,2-Dichloropropane (1,2-DCP)	Leachate <MCL	VLEACH modeling	TBD
	1,2,3-Trichloropropane (1,2,3-TCP)	Leachate <PQL	VLEACH modeling	TBD
	Benzene	Leachate <MCL	VLEACH modeling	TBD
	cis-1,2-Dichloroethene (cis-1,2-DCE)	Leachate <MCL	VLEACH modeling	TBD
	trans-1,2-Dichloroethene (trans-1,2-DCE)	Leachate <MCL	VLEACH modeling	TBD
	Tetrachloroethene (PCE)	Leachate <MCL	VLEACH modeling	TBD
	Trichloroethene (TCE)	Leachate <MCL	VLEACH modeling	TBD
	Vinyl chloride	Leachate <MCL	VLEACH modeling	TBD
Soil (non-VOCs)	Aroclor-1254	870 µg/kg	Human health hazard	1 e-05
	Aroclor-1260	870 µg/kg	Human health hazard	1 e-05
	B (a)P-TE [b] – Benzo(a)anthracene – Benzo(a)pyrene – Benzo(b)fluoranthene – Benzo(k)fluoranthene – Chrysene – Dibenz(a,h)anthracene – Indeno(1,2,3-cd)pyrene	900 µg/kg	Background	Background
	Lead	400 mg/kg	Human health hazard	IEUBK Model
Groundwater (VOCs)	1,1-Dichloroethane (1,1-DCA)	5 µg/L	MCL	Cancer risk at 2.6e-06
	1,1-Dichloroethene (1,1-DCE)	6 µg/L	MCL	HI = 0.04
	1,2-Dichloroethane (1,2-DCA)	0.5 µg/L	MCL	Cancer risk at 4.0e-06
	1,2-Dichloropropane (1,2-DCP)	5 µg/L	MCL	Cancer risk at 3.1e-05
	1,2,3-Trichloropropane (1,2,3-TCP)	1 µg/L	PQL [c]	Cancer risk at 6.2e-04
	Benzene	1 µg/L	MCL	Cancer risk at 9.0e-06
	cis-1,2-Dichloroethene (cis-1,2-DCE)	6 µg/L	MCL	HI = 0.23
	trans-1,2-Dichloroethene (trans-1,2-DCE)	10 µg/L	MCL	HI = 0.19
	Tetrachloroethene (PCE)	5 µg/L	MCL	Cancer risk at 1.2e-05
	Trichloroethene (TCE)	5 µg/L	MCL	Cancer risk at 4.9e-06
	Vinyl chloride	0.5 µg/L	MCL	Cancer risk at 2.2e-05

TABLE A-1

Cleanup Levels for Contaminants of Concern
Cooper Drum Company Superfund Site

Medium	Contaminant of Concern	Cleanup Level	Basis for Cleanup Level	Risk at Cleanup Level
Groundwater (SVOCs)	1,4-Dioxane	6.1 μg/L	PRG[d]	TBD

[a] MCLs from Title 22 California Code of Regulation Section 64431 and 64444 unless otherwise specified.
[b] Based on UTL background benzo(a)pyrene-toxicity equivalent (B(a)P-TE) concentration for southern California PAH data set.
[c] No MCL established for 1,2,3-trichloropropane. The PQL was identified as a remedial goal for 1,2,3-trichloropropane.
[d] Cleanup action level may be reassessed and any revisions will be incorporated into the RA.

DCA = dichloroethane
DCE = dichloroethene
DCP = dichloropropane
HI = hazard index
IEUBK Model = Integrated Exposure Uptake Model for Lead in Children
MCL = California primary maximum contaminant level
mg/kg = milligram per kilogram
PAH = polycyclic aromatic hydrocarbons
PRG = preliminary remediation goal
PQL = Practical quantification limit
SVOC = semivolatile organic compound
TBD = to be determined
TCP = trichloropropane
UTL = upper tolerance limit
VOC = volatile organic compound
μg/L = micrograms per liter
μg/kg = micrograms per kilogram